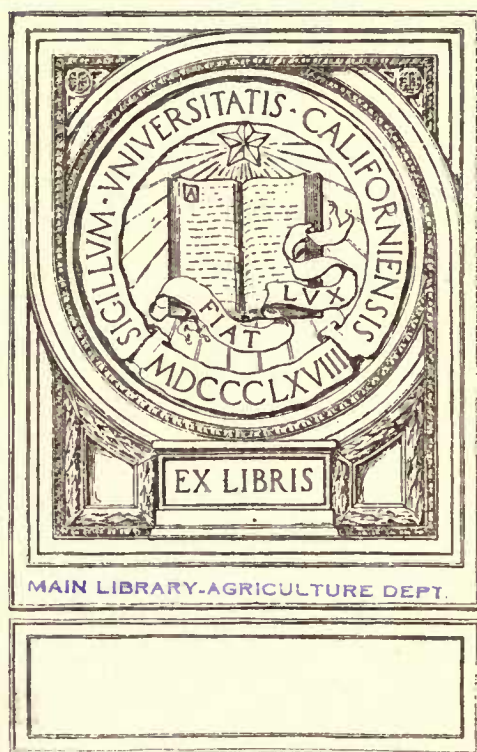


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AFFORESTATION
IN THE
UNITED PROVINCES,
INDIA.

By
E. BENSKIN, M.A., I.F.S.,
Deputy Conservator of Forests, United Provinces.



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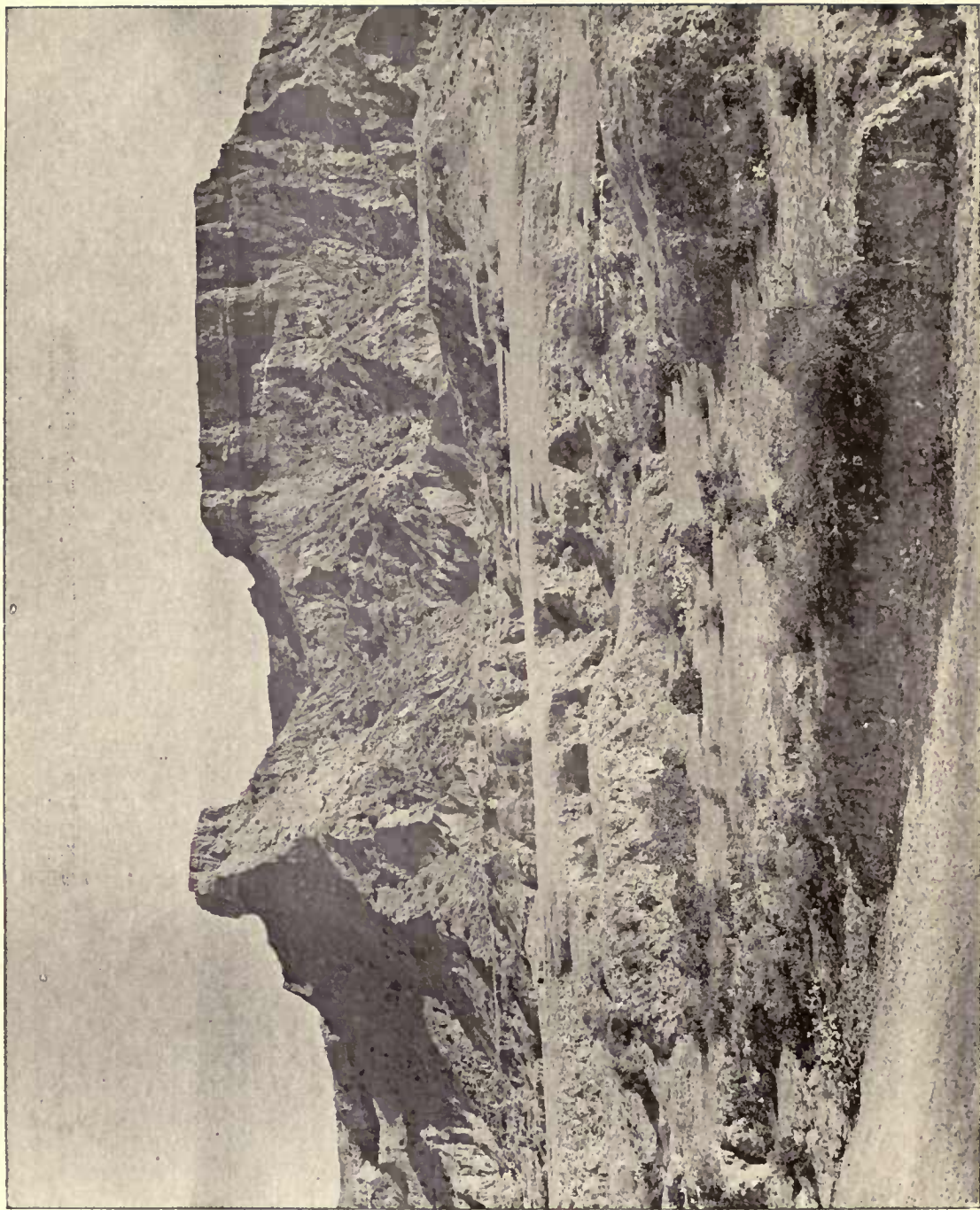
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Eroded country typical of the United Provinces and Punjab.

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AFFORESTATION

IN THE

UNITED PROVINCES, INDIA.

INTRODUCTION.

THE object of this book is to deal as briefly as possible with the history of afforestation in the United Provinces, and to place on record all important information which has been collected during the past few years. Before doing so it is desirable to describe briefly the conditions leading up to the necessity for an organized scheme of afforestation or, more properly speaking, of reafforestation.

There is evidence that the greater part of the earth was at one time or another covered with trees and shrubs differing in character according to local conditions. The increase in population has gradually made inroads on the natural forests which have consequently been considerably reduced and, in places, even obliterated altogether.

The reckless extermination of forests by the hand of man or through excessive grazing by cattle, sheep, and more especially by goats, is most noticeable in those backward countries where the people lack education and where stable government is wanting, but such a state of affairs also exists in every continent of the world. In many cases steps have already been taken to prevent this wholesale destruction by the introduction of scientific forestry in all its branches; but in many countries the forests have already been reduced far below the requirements of the people and in such countries afforestation is necessary, if only to meet the demands of the population in respect of forest produce. Of far more importance, however, is the deleterious effect of forest denudation on the preservation of a country from erosion and final sterility.

The United Provinces can be classed as a country where the reckless extermination of forests has been allowed to continue unchecked for centuries, until the present forests cover only 7 per cent. of the total area and are confined almost entirely to the hills and sub-montane regions. Out of 48 districts in these provinces only 15 districts have forests of any importance. The present reserved forests can only serve a circumscribed area and it is most urgently necessary to create new forest estates, not

only to meet the requirements of big towns but also the needs of the agricultural community. The great decrease in the area of grazing lands and wooded tracts, especially in Northern India, has been a serious matter to the people for the last 40 years and instances have time and again been given where the absence of forest areas has resulted in the death of thousands of cattle in famine years. The opening-up of communications by rail and road throughout the province has mitigated to a certain extent the severity of fodder famines, but experience shows that the expense of transporting fodder from sub-montane districts is prohibitive. The appalling rate at which that portion of the country known as the Gangetic Plain is being eroded, the increasing sterility of the soil, the sinking of the spring water levels, the severities of the climate, all of which are directly due to this wholesale clearance of the natural forests, require such an Herculean effort to combat that Government has, up to quite recent years, hesitated to take the initial step.

The Forest department, which was started in 1864 for the purpose of conserving the remaining forests, has, on occasions, been called in to assist agriculture in the creation of local fuel and fodder reserves. The earliest efforts date back from 1873, when Dr. (subsequently Sir Dietrich) Brandis gave great impulse to what has been, on occasions, termed agricultural forests in Ajmere-Merwara and, later on, in Madras. The great dislike of the masses to any restriction of their former so-called rights over the forests, their ignorance and suspicion of Government's motives, are both serious obstacles in the way of any improvement and Government policy has been apt to favour the contentment of the present generation rather than the material advantages of their successors for all time. The people in their present condition are likely to do little to find a remedy for these evils and it is only within the power of Government to do anything to ameliorate the present state of affairs; action should no longer be delayed.

The necessity for burning dung for domestic purposes owing to the scarcity of firewood, thus robbing the soil of its fertility, is quite sufficient reason for drastic action, but it is intended to show further how essential forests are for the very existence of agriculture.

Anyone who wishes to study the close relationship of forests to agriculture is recommended to read Dr. J. A. Voelcker's comprehensive report on the improvement of Indian Agriculture, 1893 (Eyre and Spottiswood). It will be readily understood that those forests which are essential to the preservation of the country and for the improvement of agriculture should be managed quite apart from any commercial considerations.

Chapter I.

PHYSICAL IMPORTANCE OF FORESTS.

As has been stated already in the introductory notes, a new country is almost invariably covered with dense forests, which are gradually cleared away by the first settlers to make room for agriculture and to improve the general salubrity of their surroundings. This process continued without restriction in these provinces until the forests receded for the most part to those regions topographically or climatically unfit for agriculture, and even here they have often been destroyed by physical causes resulting from the wholesale clearance of forests elsewhere. Forests are Nature's means of dealing with the meteorological forces. It is believed that all rain clouds are derived from the sea and are driven over the land where they deposit their moisture, becoming poorer in moisture-content the further they travel inland until the point of exhaustion is reached. A forest air and soil are always far damper than that of a cultivated or barren plain, and the continuous transpiration of a forest creates a wet halo which serves to enrich the winds with moisture and increase their precipitation. The geographical position of forests is, therefore, of great importance especially in the case of an inland country.

Forests by means of their foliage, root system, and litter serve as a protection to the earth against erosion and the rapid run-off of water, thereby causing a more even and regular supply to the rivers of the country. Forests are consequently of great physical importance on mountains and hills in checking the rapid wastage of water and preventing floods which cause the erosion of the country far down stream. It is not claimed that forests can prevent floods caused by exceptional meteorological conditions, but it is certain that without their mitigating influence the floods are more severe and destructive. There is no doubt that in olden times most of the big rivers of these provinces were used to a far greater extent for navigation; at the present time the floods are generally too dangerous to negotiate during the monsoon months and during the rest of the year they are too shallow for craft. It has been calculated that the surface wastage from a deforested hillside is seven to thirteen times the water wastage from a similar forested hillside. The great variations in the flood levels of the rivers of these provinces is partly due to water being taken off for irrigation but also very largely attributable to excessive forest clearance.

The close relation of forests to stream flow and inland navigation is fully appreciated in America; in India, where irrigation is so important, it is surprising that it should have received so little

attention. Forests also tend to mitigate the severity of the climate by reducing the extremes of heat and cold.

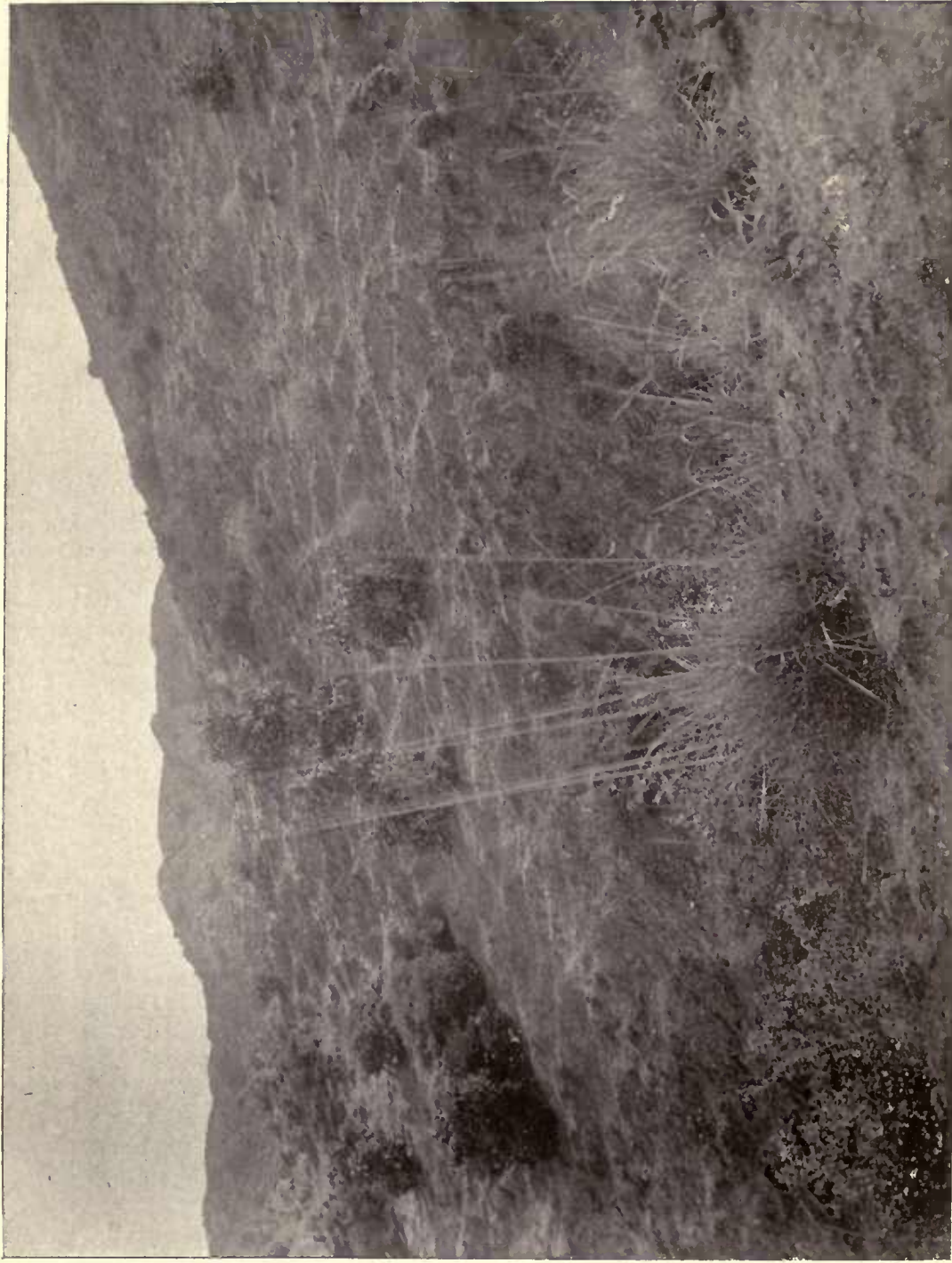
In framing the policy for the conservation of the existing forests the Government of India have roughly classed them into four divisions:—

- (a) Forests the preservation of which is essential on climatical or physical grounds ;
- (b) Forests which afford a supply of valuable timber for commercial purposes ;
- (c) Minor forests (fuel and fodder reserves) ;
- (d) Pasture lands.

The importance of category (a) forests has for many years been fully appreciated by Government and they are to be protected regardless of interests which it may be necessary to restrict. In these provinces, owing to the small area of forests, it might be justifiable to class almost all forests under this head although not actually recognized as such. It has already been explained that forests should not in every case be managed from a direct commercial standpoint, indeed, it may be necessary to expend very large sums of money in the maintenance of so-called physical forests, with only indirect benefits to the State and the community.

ECONOMIC IMPORTANCE OF FORESTS.

As the scope of this book is to show the origin and progress of afforestation in the United Provinces it will scarcely be necessary to dwell at length on this portion of the subject. The present forests are to a great extent, capable of supplying most of the commodities required by the big commercial centres although their remoteness is a serious handicap. It has been stated that 25 per cent. of a country should be devoted to forests in order to meet indigenous demands : in these provinces the forested area represents only 7 per cent. and the neighbouring provinces, being in a similar position, cannot be depended upon. The greatest need of the moment is for the creation of agricultural forests in woodless districts for the supply of firewood and small building material to the agricultural community and improved pasture for the cattle. The Famine Commissioners, who were appointed in 1880 to enquire into the means of mitigating the severities of famines, strongly represented the necessity for the creation of such forests and the Government in their resolution on the Commissioners' report suggested that an enquiry should be made by district officers with a view to ascertaining how far cattle needed protection, and what lands were available for the creation of *fuel and fodder reserves*. It was this order of the Government of India that gave the first impetus to a policy of afforestation.



The denuded Siwaliks in the Hoshiarpur district, Panjab.
The sand and ground now brought down by floods is continuously destroying cultivation below.

Chapter II.

THE EFFECT OF DISFORESTMENT

Before proceeding further with the progress of the policy of afforestation referred to above it is necessary roughly to describe the effect of unregulated forest clearances in different parts of the world and especially in these provinces.

We know that the sands of the Sahara and Arabia now cover what was once a fertile land, and that many countries such as Greece, Tripoli, and Palestine are now only able to support a scanty population. Ancient historians speak of the equable climate of Greece, then densely-wooded, and of the perpetual spring of Babylon. Babylonian tablets of great antiquity refer to the attempts to reclaim the country thrown out of cultivation by the sinking of the spring level and erosion, but these efforts were only of temporary benefit. The floods from the mountains increased year by year, the beds of the rivers were scoured out, irrigation became impossible, and the countries gradually developed into their present desert condition.

Many interesting examples of the effect of disforestation can be found in almost every country. The United States of America and South Africa have suddenly awakened to this danger and the scientific papers are full of glaring instances of erosion, soil deterioration, and exhaustion. In many countries of the old world the disastrous effect of disforestation has been appreciated and laws have from time to time been enacted to prevent the destruction of forests, the most interesting being the old French law of 1669. To come closer home, we have the case of the Hoshiarpur *chos* in the Punjab where, as a result of the destruction by unrestricted grazing and the cutting down of the woodland growth on the Siwalik hills, the river beds have become choked with stones and sand. These dry *chos* are constantly widening their beds at the expense of cultivated fields. After heavy rain they become raging torrents carrying destruction far and wide, but after a few hours the flood water passes on and the *cho* resumes its normal waterless state. Hence, instead of having perennial streams watering a fertile land, the country is intersected with these wastes of stones and sand producing nothing of any value to man or beast. In 1910 many acres of cultivation were carried away by the sudden flooding of the Kosi and Ramganga rivers: similar instances could be given in every sub-montane district.

The China landslide at Naini Tal with its attendant loss of life will be remembered by many. Such landslides of which many might be mentioned, are very similar to those in the Savoy Alps on the afforestation of which the French forest department maintains a separate staff of officers. It is realized that such places must be afforested and protected for the safety of the people regardless of cost and monetary returns. For the purpose of this book it is proposed to deal mostly with the country washed by the Jumna river as it is in this portion that immediate action is required.

THE JUMNA VALLEY.

The Jumna takes its rise in latitude $31^{\circ}2'$, longitude $70^{\circ}27'$ about five miles north of Jumnotri and eight miles west of Bundarpunch peak in the Himalayas. Its length from its source to the confluence with the Ganges is 860 miles. It has 17 tributaries, of which 5 rise in the Himalayas, 3 in the Siwaliks, 3 in the Vindhya Hills, 1 in the Satpura Hills, and 5 in the plains of the Doab. If the reader will pick up a map showing the distribution of forests in relation to these rivers, he will see how insufficient or altogether absent is the regulating belt of forest to control the sources of these streams. In addition to this insufficiency many of the forests are open to the grazing and browsing of cattle, resulting in the deterioration of the soil covering and ultimately to the destruction of the forest. This process is accelerated by the wasteful habit of burning the forest practised by the village people. Anybody who has visited the Dehra Dun and Saharanpur districts cannot fail to be impressed with the enormous damage done by sudden floods from the Himalayas and Siwaliks and it is not surprising to find that the area under cultivation in many villages of the Saharanpur Tarai has decreased during the last 50 years. The sub-montane rivers have been continually changing their courses, causing the land to be covered with a deep boulder deposit absolutely unfit for cultivation. If grazing were entirely excluded the old beds would very quickly become covered over with a dense crop of shisham (*Dalbergia Sissoo*) and Khair (*Acacia Catechu*) which would form a very efficient natural training and obstruction work against the force of the floods. Unfortunately a large portion of these forests are open to grazing and the young seedlings are browsed down every year, the beds have widened, and the force of the floods has increased; for these various reasons the vegetation on the neighbouring hills is of a very poor description and, owing to much of the soil having been carried off, the water flows away with great rapidity, thereby



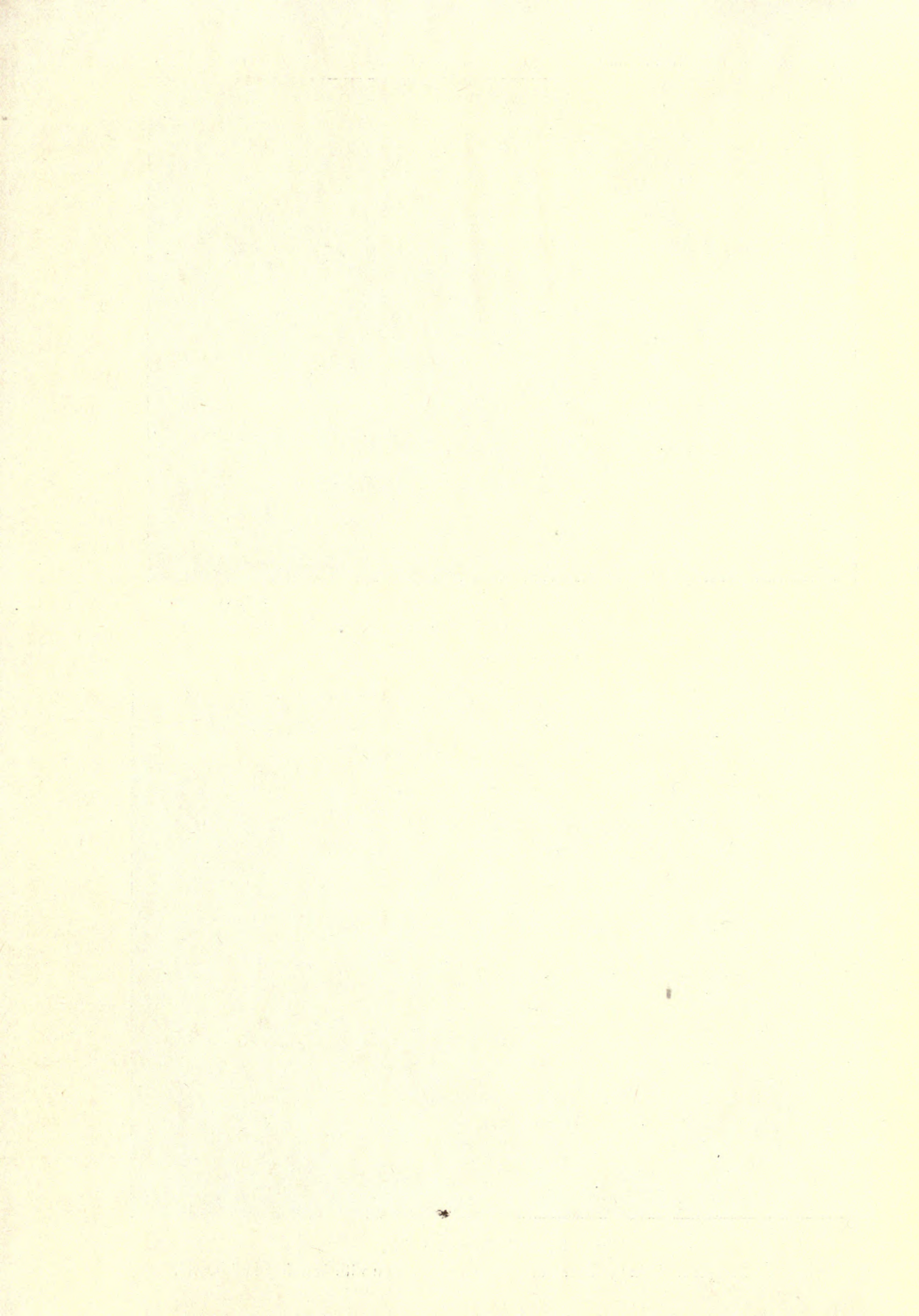
Photo. by Courthope.

Gangotri the source of the Sacred Ganges.



The disforested Mussoorie hills.

Note the consequent choking of stream beds and cultivation with boulders and gravel.





Photo, by Troup.

A stream bed in the Siwalik Hills closed to grazing.
Note the more defined river bed and natural forest growth.



Hillside erosion in Appalachian mountains.
The timber was removed and the erosion followed cultivation of soil.
Finally the field itself was abandoned. (By courtesy of American Forestry).

increasing the volume of the torrents and leaving the beds dry a few hours after a storm. Irrigation works have been destroyed by these sudden floods and they are a source of anxiety to the engineer. A similar state of affairs can be found on almost every hill tributary of the Jumna. The slopes close to Mussooree, for instance, were completely covered with dense oak forests and, even within the memory of residents now living, they have been denuded of their forest crop by the private owners and by the *muafidars* of Tehri State. The resulting effect of disforestation has been so rapid that the same *muafidars* actually submitted a petition asking that their forests might be managed by the Forest department but this petition was refused on political grounds.

The accumulated effect of this flooding and scouring has resulted in the bed of the Jumna at Etawah being lowered 60 feet in the last five hundred years with a corresponding sinking of the spring level. The cold weather level of the river in the Etawah and Jalaun districts is often 180 to 200 feet below the general level of the immediately surrounding country, and the well water levels are sometimes as low as 200 feet. The banks of the Jumna in the Agra, Etawah, and Jalaun districts are now so completely drained that they have become almost destitute of vegetation except for a desert flora, and even this is disappearing. This dry belt is increasing at the rate of 250 acres every year in the Etawah district alone. The absence of protective vegetation on the banks and the flow of water from the high plateau to the rivers has caused a complicated net-work of ravines. These ravines often start suddenly at the edge of cultivation with a drop of some 80 feet, or they may be less severe; they take up a meandering course, joining up with other systems, eventually falling into the river. The actual area of similar lands in the province is some millions of acres. The land at present is almost valueless to the owners as it yields only grazing of the very poorest description.

Cultivation beyond this desert belt is precarious even in years of normal rainfall, and drinking water often becomes so rare as to necessitate the migration of whole villages, and throughout the expanse of the ravines there is no water to be found except in the main rivers. A study of the soil will show that it is very fertile, but it is too out up and arid for cultivation. The monsoon rains only sink to the depth of a few inches and, below this, the soil is quite dry till the spring level is struck. It would appear that the present tree-growth is of very great age and has continued to reproduce itself by coppice shoots. Natural reproduction invariably dies down as soon as the rains cease.

In the districts known as the Bundelkhand portion of the province the same depressing state of affairs exists on a very large scale. Attempts have been made by Government for some years to dam up the ravines but it is impossible to keep pace with the damage and there is no doubt that within a few generations large tracts will go out of cultivation altogether. The work of protecting and reclaiming eroded land in these districts is in the hands of the Irrigation department.

There are two ways of dealing with serious erosion : (1) the artificial way of the engineer ; (2) the more natural way of the forester. Mr. Moreland, C.S.I., C.I.E., I.C.S., in his notes on the agricultural conditions and problems of the United Provinces describes both these methods. "To minimize the extensions (of erosion) the essential is to reduce to the lowest possible amount the run-off from the land lying above the ravines and draining above them. This result is obtained by the field embankments of Bundelkhand, and their continued construction is most desirable on these grounds alone. In the rest of the provinces the land just above the ravine is, as a rule, unirrigable, and in accordance with the custom of the country is sown with a *kharij* rather than with a *rabi* crop. Naturally when the rainfall is heavy (and here is the danger of the artificial method) either the field boundaries break or the cultivators cut them to save their crops and most of the flood passes direct into the ravines, a large proportion of the extension is thus directly traceable to the effects of sudden heavy rainfall.

"It is highly probable that if the border fields were sufficiently embanked to retain the moisture and left uncropped during the rains they would be used for *rabi* crops even without irrigation ; but it is at least doubtful if the *rabi* yield so obtained would be greater than the *kharij* that would be sacrificed and very doubtful if it would pay the cost of embanking. Experiments on this point are however desirable.

"An alternative method of reducing runoff is to use the land above the ravines as a fuel and fodder reserve and there is reasonable prospect that this will pay the landholder, provided he is within easy reach of a market for babul bark, and provided he can wait for a cash return until the period when the first crop of babul matures."

The drying-up of the country is a most serious matter which may be temporarily relieved by the expenditure of *lakhs* of rupees on irrigation, but if the erosion of the country continues at the present rate, irrigation projects will be hampered and eventually become impossible. The Etawah district was once covered with

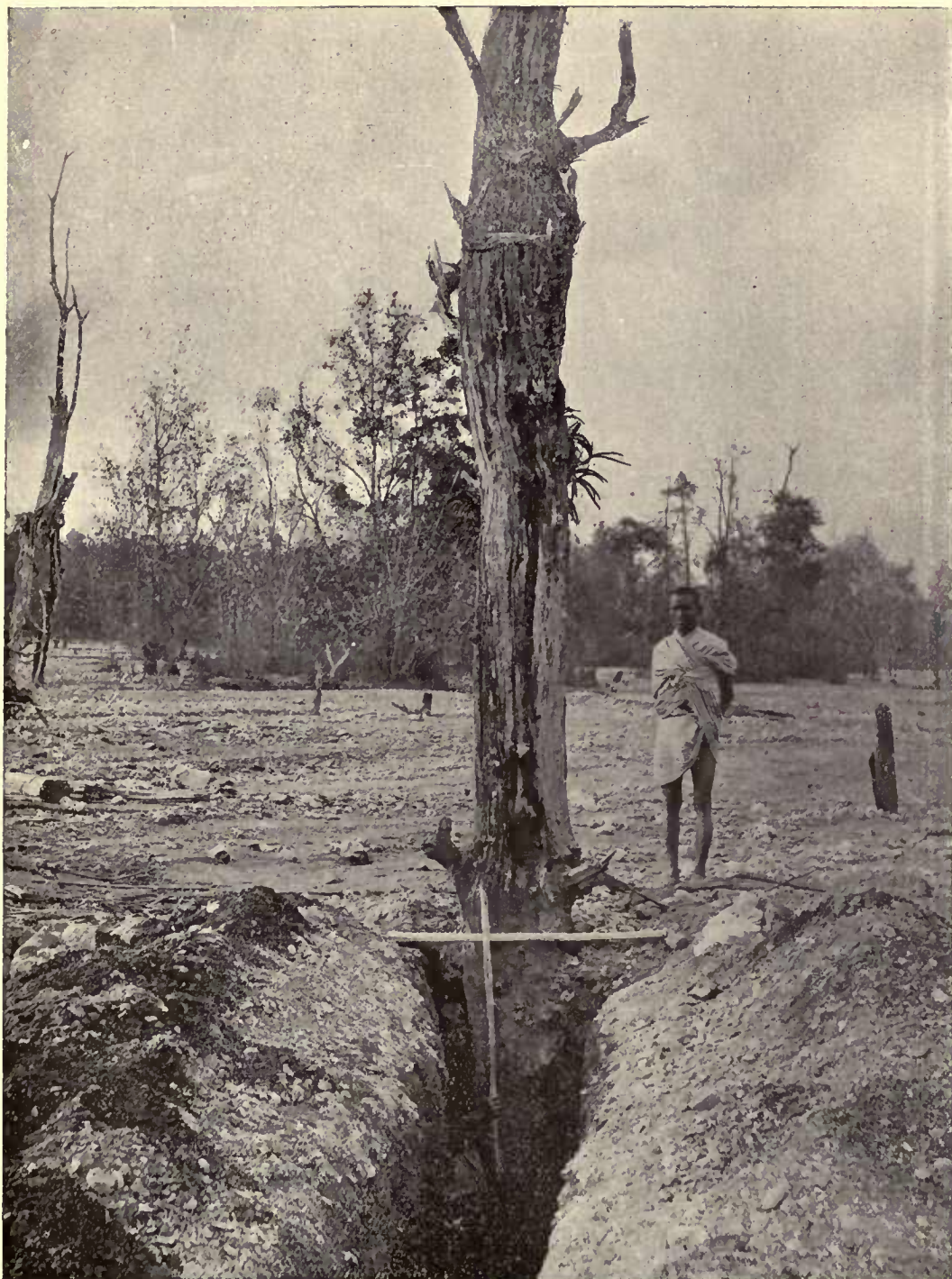
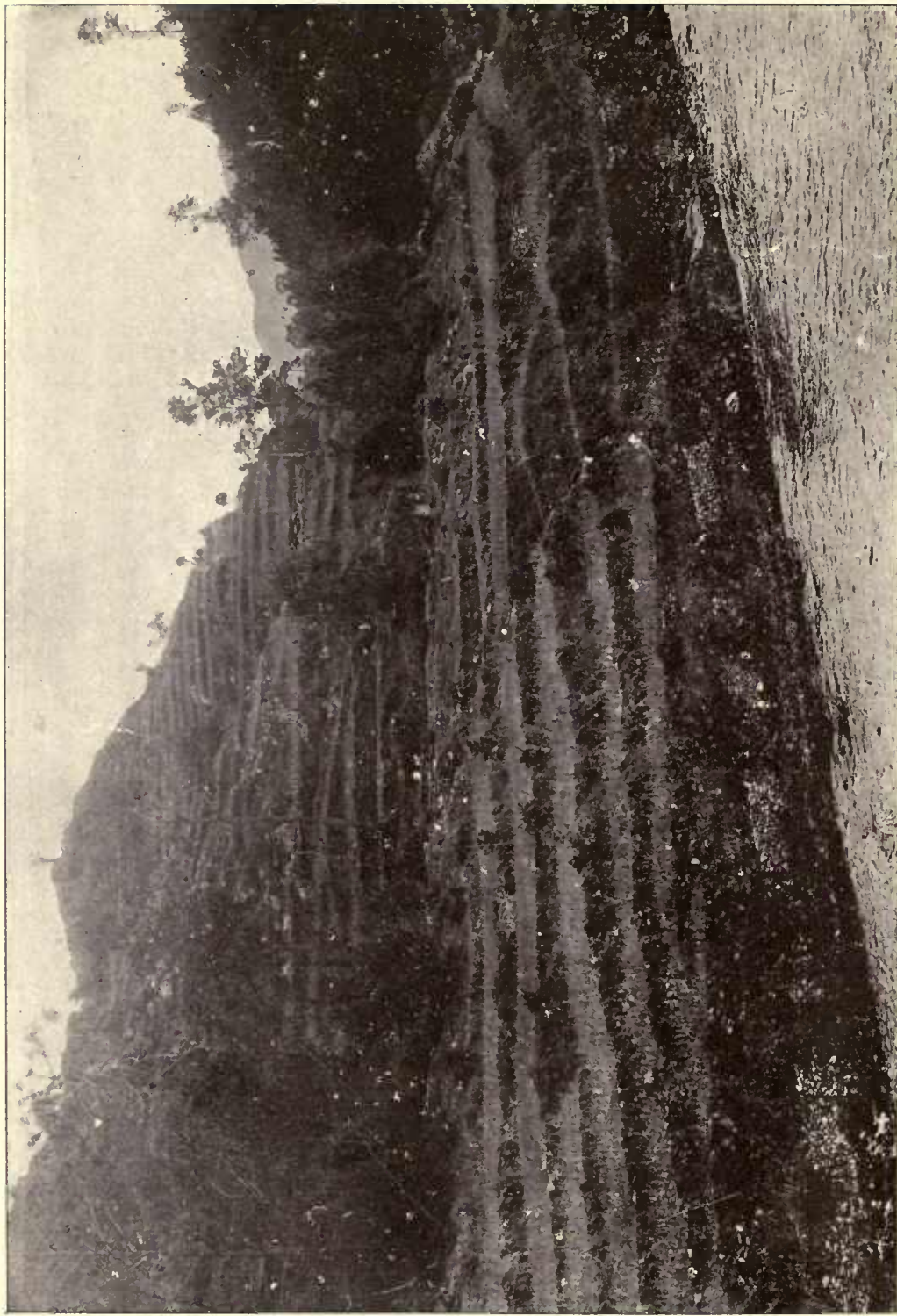


Photo. by Sen Gupta.

Trees destroyed by gravel brought down from the hills.
Note the man in the pit who is standing on original soil level.



All cultivation on hillsides, except on terraces as shown above, should be prohibited.
Ordinary clearances for cultivation invariably lead to erosion.

sal (*Shorea robusta*) forests and many villages are named after the tree—Sakhi Sakrauli, Sakhua, Sakhopur—and it is recorded that the Emperor Babar hunted in these forests. The sal tree requires a moist climate, but the conditions have so changed that there is scarcely a single tree between the Himalayan Tarai and the Satpuras. The drop in the Jumna level is established by the prevalence of old sugar mills in the Etawah trans-Jumna area where the water level is now far too low to admit of irrigation, and also in the fort at Shergadh near Auraiya where the curb of the large well in use in 1550 is now 60 feet above mean flood level.

The whole aspect of the ravine country is most depressing; during the hot weather the temperature rises to well over 125° F. in the shade, of which there is practically none, and there is a remarkable absence of life in these tracts during these months.

The Etawah district has been specially described for reasons which will be understood later on in this record, but identical conditions prevail in such districts as Jhansi, Jalaun, Hamirpur, Agra, and Banda as can be seen from the short accounts abstracted from the settlement reports and gazetteers, which have been added as appendix I of this book.



The goat is responsible for the greatest damage to forests.

Chapter III.

THE PAST AND PRESENT POLICY OF GOVERNMENT REGARDING AFFORESTATION.

Up to the present, the conditions leading up to the necessity for afforestation have been described and it is now proposed to deal with the actual progress made in this direction.

The question of utilizing the waste lands in the Agra, Etawah and adjoining districts and establishment of fuel and fodder reserves was the subject of a report in 1879 by Dr. D. Brandis, then Inspector-General of Forest to the Government of India. In the report attention was drawn to the large tracts of ravine country lying on both sides of the Jumna river and the extent of wastes to be found in several districts of the Doab. The measures recommended in this report for the encouragement of forest growth on these lands were (1) the exclusion of fire; (2) restriction of grazing; (3) the prohibition of all wood-cutting; (4) filling up of blank areas by planting and sowing. The report recommended the acquisition of suitably situated and sufficiently large blocks of waste land which should not be too far from the markets of the produce.

Dr. Brandis's
report.

On this report instructions were issued to District Officers to ascertain and report, after consultation with the Conservators of Forests, whether suitable blocks of waste land could be obtained for the purposes indicated. The tracts of country recommended for afforestation were in due course inspected by a Forest officer who was unable to recommend the scheme on financial grounds. The practice, even now in force, of meeting capital expenditure on forest development from current revenue was no doubt largely responsible for the failure to expand and progress was also hampered by an insufficient staff.

The urgent necessity of increasing the area of fodder and fuel reserves in order to mitigate the severity of famines was again brought to the notice of the Government of India, who, in March, 1883, issued a resolution instituting further enquiry as to how far such provision was essential. The result of these enquiries, however, did not uphold the assumption that the area of grazing grounds and wooded tracts had recently decreased to any large extent or that there was a growing scarcity of fodder or fuel and it was again recorded that the further extension of existing areas would be a matter of great expense and the results uncertain. It was decided to postpone operations on a large scale until the

results of certain experiments on a small scale, which had already been started, were ascertained.

Fisher forests.

In spite of every discouragement, Mr. J. H. Fisher, I.C.S., in 1884, determined to start on his own and for this purpose he called together the zamindars who owned a large tract of ravine land, some eight square miles in extent, situated to the west of the town of Etawah; and these proprietors agreed to hand over their land for the creation of a fodder and fuel reserve and for the protection of the ground from erosion and further deterioration. The owners of the land were to provide the necessary funds and in return the profits were to be divided *pro rata* according to the money furnished and the land held in each case. The management of this reserve was entrusted to the Collector, who placed the area under working in the same year. Grazing was prohibited in the area, the soil broken with the country plough, and seeds of babul, neem and shisham sown; and in order to dam up the rain water and locally raise the spring level which was extremely low, *bandhs* were thrown across the ravines in suitable places. Besides these sowings, planting of various species was undertaken.

Although this forest remained under the management of the Collector till 1902, very little is known of the actual results except that a fairly good crop of babul was established, sufficiently dense and valuable to encourage a business firm to take and work the forest for the bark on a lease for 50 years at a purchase price of approximately Rs. 2 per acre and an annual rental of Re 1 per acre.

The scheme worked well for a time, and it was felt that if it proved a success it might be copied by other landowners in the hundred square miles of similar country in the district and that there would consequently be no need for Government interference.

Beyond the Etawah scheme nothing much was done except the preservation of some existing forest tracts for protective reasons until December, 1901, when, at the instance of the Military department, an enquiry was held into the means by which the supply of babul bark for the tanneries at Cawnpore could be most effectually increased and the possibility of establishing babul reserves within easy reach of the factories. Mr. Hobart Hampden, Deputy Conservator of Forests, was deputed to this enquiry, with the result that a small experimental plantation (850 acres) was started in the ravines adjacent to the railway line at Kalpi, district Jalaun, and a further small plot of level cultivated land known as Piprayan (162 acres), situated four and a quarter miles south-east of Ata railway station, was acquired. Mr. Hobart Hampden's whole scheme, which covered an area of 10,800 acres, was not accepted until the experiment

Kalpi babul
plantation.



Typical ravine scenery in the Etawah district ;
there are over 100,000 acres of this type of land in the district.



Photos. by C. E. C. Cox, I. F. S.

The commencement of a ravine showing typical erosion.

proved successful. Actual sowing operations were started in 1904-5 over nearly the whole area, sowing being made in strips ploughed with country ploughs, on re-filled pits and on ridges. A beginning on a small scale was also made with ravine control by constructing small dams across the ravines. Time and again the whole area was sown with babul and many times the results looked hopeful, especially the sowings on ploughed land, but success seemed always to be marred either by severe winters, drought, rats, or disease and after eleven years successive sowings the area was by no means fully stocked. Other species of trees were also tried experimentally with various results. Although the success of these plantations from a financial point of view was not encouraging it was most interesting and valuable as an object lesson, for it clearly demonstrated that not only could ravine lands be successfully controlled and erosion arrested, but they could also be formed into very valuable fodder reserves and there was no doubt that, with correct soil-cultivation and choice of species, this class of ground could also eventually yield a valuable forest crop.

In addition to the experiment at Kalpi, a survey of existing private forests in the Hamirpur district was carried on in 1910 in order to ascertain the existence of any valuable forests of babul in that district and what measures were advisable for the preservation and extension of babul cultivation in the ravines. The work was entrusted to Mr. Whitehead, Deputy Conservator of Forests, who drew up a report recommending the acquisition of certain blocks of babul forests in the north of the district. The afforestation of the ravine tracts as a profitable undertaking was however not recommended but the attention of Government was again drawn to the seriousness of the soil erosion in this district.

Action was taken on the recommendation and 4,448 acres of open babul forest situated near Kunehta and Bandhur Bazurg in the Maudaha tahsil were acquired in 1913 at a cost approximately of Rs. 10 per acre.

Early in 1912 the necessity for a definite policy regarding the creation of new forests, especially those required to meet local agricultural requirements, was again laid before the Local Government by the Conservator of Forests Eastern circle, United Provinces (appendix II) with the result that a systematic survey of the available areas was ordered, combined with a series of experiments in afforestation in the various localities.

A general idea was also adumbrated as to the lines on which the Government proposed to extend this work and the financial assistance which they were prepared to afford to private enterprise (appendix III).

Hamirpur
babul planta-
tions.

Government
resolution no.
348 of 26th Au-
gust, 1912.

Afforestation division.

Mr. E. A. Courthope, Deputy Conservator of Forests, on return from leave at the close of 1912, assumed charge of the newly-created Afforestation division as indicated in the Local Government resolution.

An inspection was made of waste land along the left bank of the Dhasan river, the right bank of the Betwa river and round Garotha, the ravines round Kalpi in the Jalaun district and stretches of waste land and old fallow which abound in the Hamirpur district. In this connection it is worth recording that there is an area of 418,747 acres of land classed as barren in the Jhansi district, exclusive of village sites, etc., and a further area of 639,038 acres of old and abandoned fallow.

For experimental purposes the newly acquired babul plantations in the Hamirpur district and the Kalpi Plantations belonging to the Ordnance department were transferred to the management of the Afforestation officer. Later in the year, the lease of the plantations (2,832 acres) at Etawah, already referred to, was assigned by Messrs. Cooper Allen to Government for the remaining 39 years for the sum of Rs. 2,500 and a small plot of adjacent land (80, acres) was bought outright from the same firm for Rs. 696.

Experimental plantations started.

Mr. Courthope's report on the Etawah district waste land.

Mr. Courthope's survey of existing waste lands was being continued and he was so much impressed with the conditions existing in Etawah that in 1913 he submitted a detailed report of that district in which he advocated the acquisition of 100,000 acres of ravine land along the Chambal and Jumna rivers for afforestation (appendix IV). The scheme being on such a large scale and affecting a great number of people a special committee consisting of officials and non-officials was formed to examine the proposals and submit recommendations.

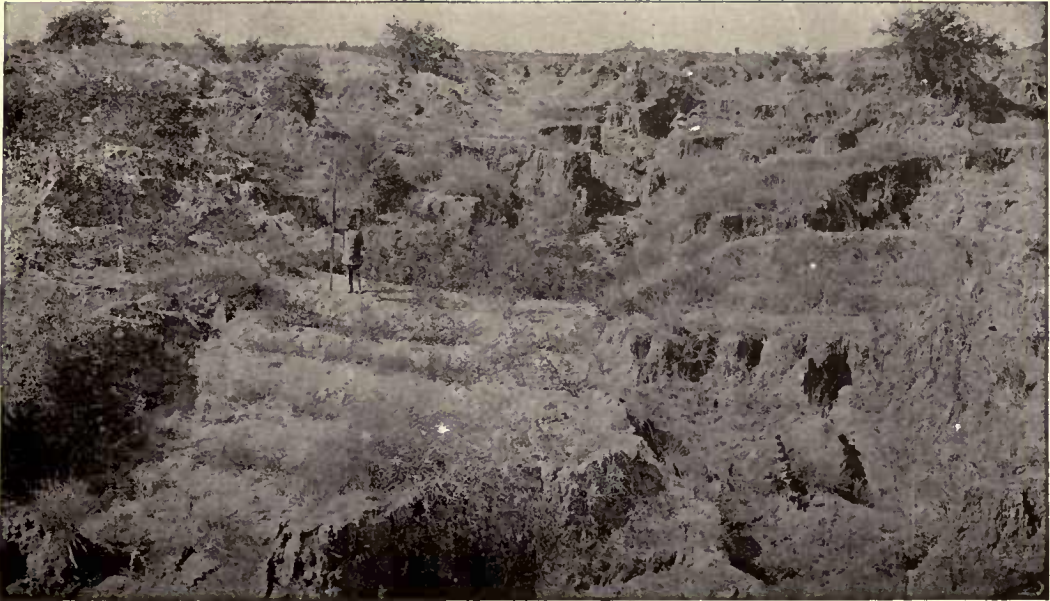
Etawah Forest Conference.

The committee met at Etawah on the 21st and 22nd July, 1913, and it was decided that it was inadvisable compulsorily to acquire the land, if control could be obtained by other means. It was recommended that operations should be started if the area obtained was large enough to secure economy of management (appendix V).

Extension of experimental plantations.

Meanwhile silvicultural experiments were being carried out in the areas under management and these latter were extended by the acquisition of blocks of open babul forest at Panwari (718 acres) and Bijrari (621 acres) in the Kulpahar tahsil and at Dhangawan (228 acres) in the Maudaha tahsil of the Hamirpur district at a total cost of Rs. 13,461.

It should however be noted that the acquisition of these lands for improving the supply of tan bark to Cawnpore was contemplated before the formation of the Afforestation division.



Head of a ravine being reclaimed, Bandh in foreground. Result of one year's work.

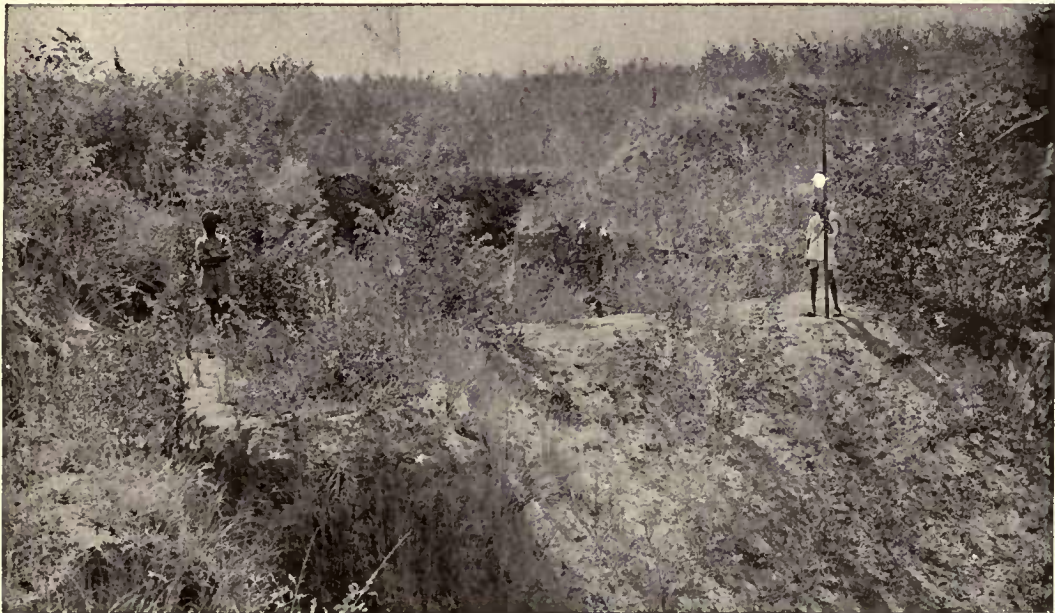
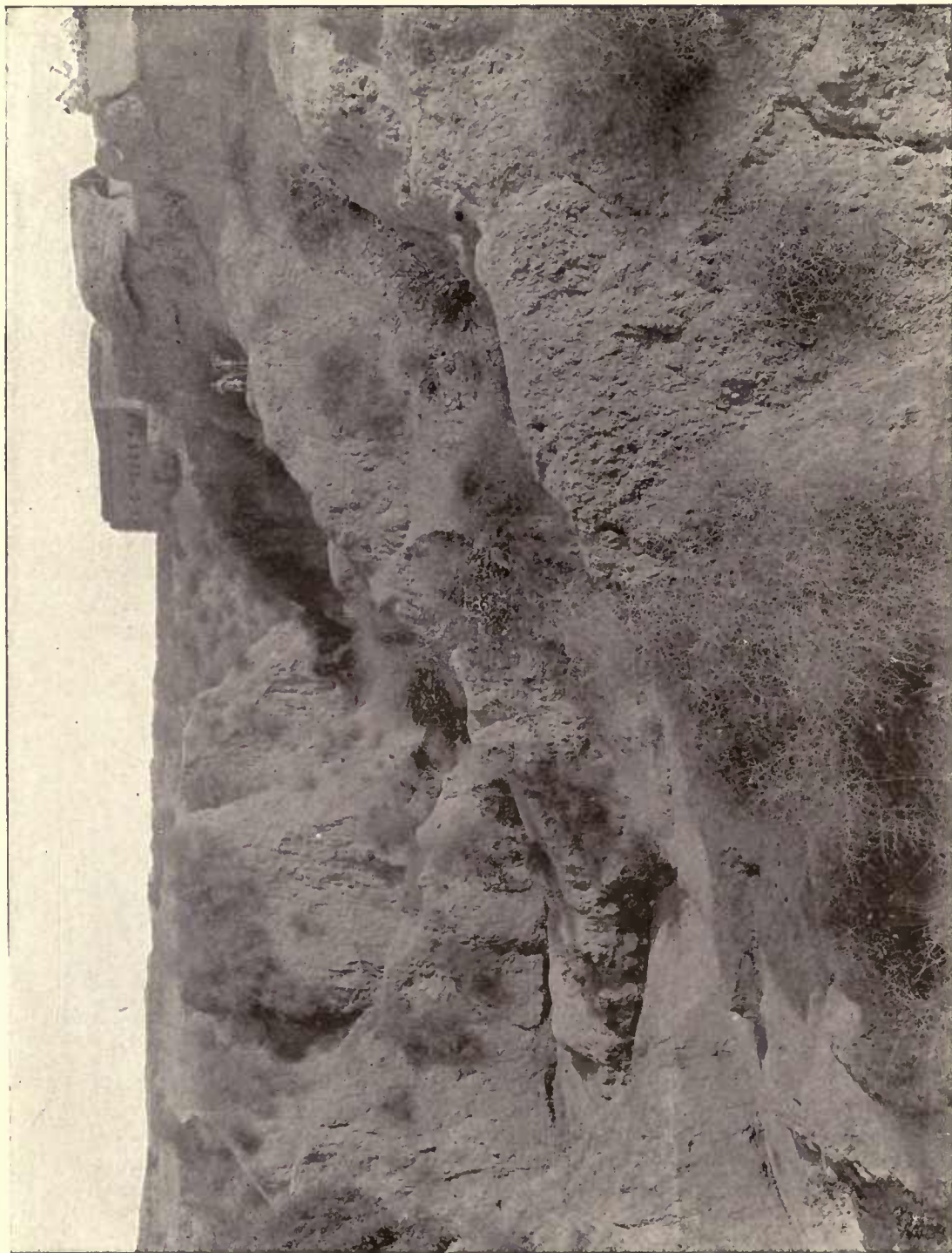


Photo. by O. E. O. Cox, I. F. S.

Head of a ravine being reclaimed. Result of two years' work.



A village threatened by ravine erosion.

An area of 130 acres (known as the Allenbagh), situated near Nawabganj, Cawnpore, was also acquired in the same year at a cost of Rs. 2,670 as an experimental ground for afforestation. This scheme was generously assisted by Mr. H. D. Allen, who constructed a dam across the main ravine at a cost of Rs. 9,000. An account of these silvicultural experiments will be given later on.

In September, 1914, the Local Government ordered a regular survey of the country, especially in the Jhansi and Agra districts, for (1) ravine reclamation and (2) for the establishment of fuel and fodder reserves in favourable localities. For this purpose Mr. Fremantle, late Principal of the Agricultural College, Cawnpore, was instructed to make the survey in close co-operation with Mr. Courthope, the Afforestation officer. Those orders were included in resolution no. 971, dated 21st December, 1914, which also outlined the general policy of the Afforestation division (appendices VI and VII).

Resolution no.
971 of 21st De-
cember, 1914

It was hoped that successful Government plantations, established in a variety of places in the ravines, would induce many landowners to follow the same example, and it was stated that the duties of the Afforestation officer should be mainly advisory and that direct action by Government was not desirable. A survey was accordingly made of the ravine lands in Bundelkhand, Agra, and Muttra districts and a report submitted. The main features of this report were—

- (1) It was indicated that for the reclamation of ravine tracts, a certain amount of tree-growth was essential.
- (2) That the reclamation of ravines by afforestation (fuel and fodder reserves) was likely to prove remunerative in the more accessible areas, but by growing timber in the more distant areas, they also could be made to pay their way.
- (3) The reclamation of ravines in remote areas should be considered only as protective works.
- (4) Both officers were strongly of the opinion that at the present juncture landowners could not be relied upon to do anything at their own initiative or at their own expense towards reclaiming and afforesting their lands.
- (5) It was suggested that the only method by which reclamation could be satisfactorily dealt with was for Government to lease or acquire the land.
- (6) It was doubted whether the terms (which will be dealt with later) of management proposed for the Etawah ravines would appeal to landowners generally. It was also doubted whether this work, requiring great supervision and technical knowledge, could be done by private

Messrs. Court-
hope and Fre-
mantle's report
on the ravines
of Agra, Muttra
and Bundel-
khand.

enterprise through *tagavi* loans, and Government control, in some form or other, was considered essential.

- (7) The suitability of ravine reclamation for famine labour was also explained.
- (8) The necessity for a specially trained staff before any extension could be made was insisted on and it was suggested that the necessary staff should be trained locally, the superior staff being deputed to Roorkee and Saharanpur to study engineering and gardening respectively.
- (9) A number of blocks in Jhansi, Hamirpur and Jalaun were described in which it was thought operations could be started, special consideration being given to—
 - (i) proximity to areas already under reclamation;
 - (ii) the necessity of increasing the existing blocks to economic size;
 - (iii) the suitability of the blocks for famine relief works;
 - (iv) the accessibility of the blocks; and
 - (v) the sentiment of the landholders concerned.

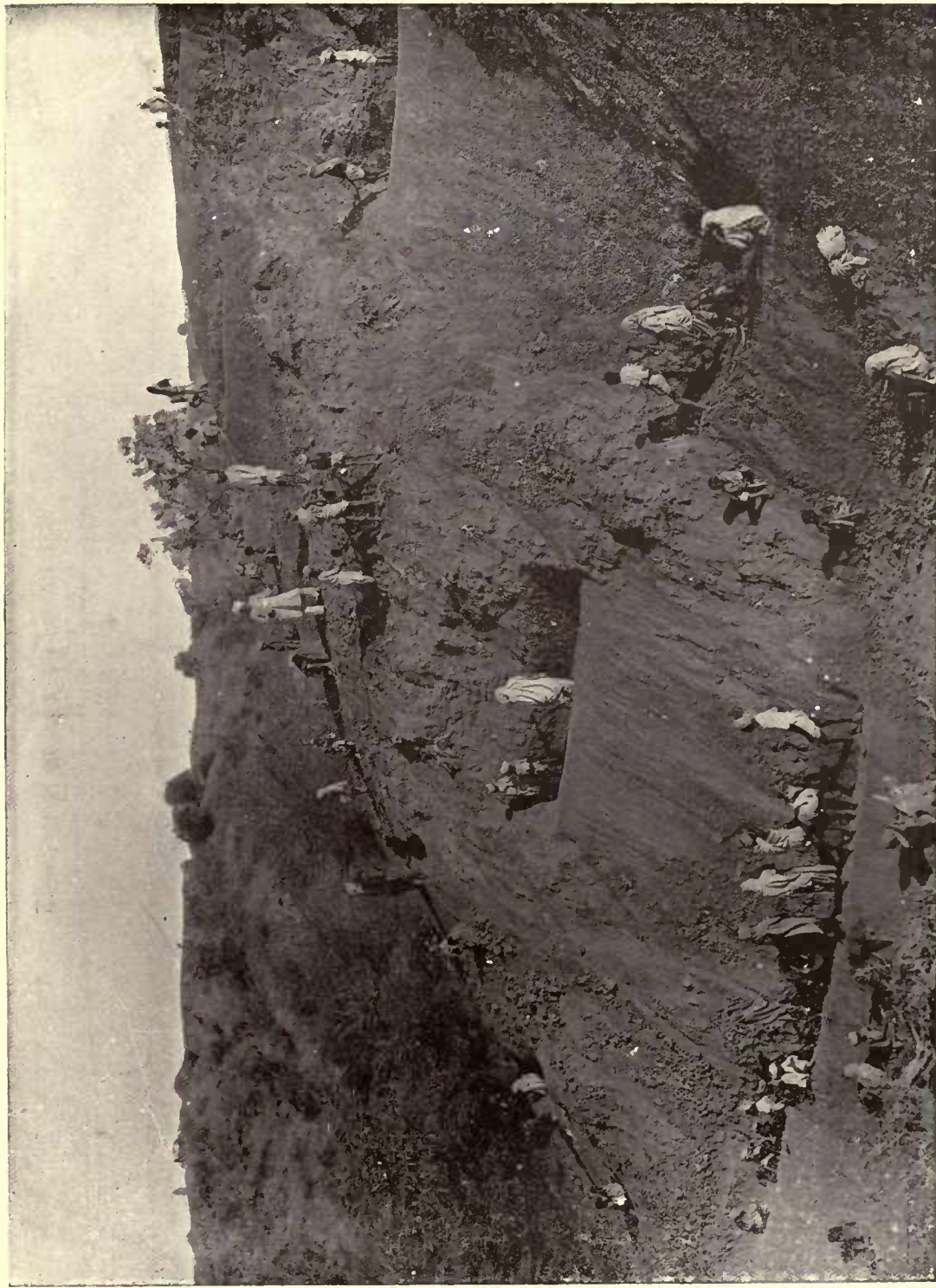
The scattered blocks of ravines in the Muttra district were considered unsuitable and the Agra district ravines were the subject of a special report (appendices VIII and IX).

The whole of the agency to be employed in reclamation work was discussed by Government in their orders on this report, and it was suggested that it would eventually come under the direction of a special branch of the Agricultural department with assistance from the Forest department; letter no. 259-L. of the 6th August, 1915, to the Director of Land Records and Agriculture, United Provinces (appendix XI). Mr. Fremantle was consequently posted to the Afforestation division as an agricultural expert in December, 1916, and proposals were submitted showing how the work should be divided up between the two branches. These proposals indicated how essential forestry was for the permanent reclamation of the ravines and how difficult it was to split the work up; Mr. Fremantle shortly afterwards resigned and the work remained under the Forest department.

Concurrent with these declarations of policy a big step forward in afforestation was made in the Etawah district as a result of the Etawah Conference. Certain big landowners, notably the Rajas of Bhareh and Partabnair, approached Government under section 38 (Indian Forest Act no. VII of 1878) for the management of certain ravine areas, aggregating about 30,000 acres, as fuel and fodder reserves. The terms under which this was undertaken were drawn up (appendix XI) and the Etawah Afforestation division was formed with effect from the 1st April,

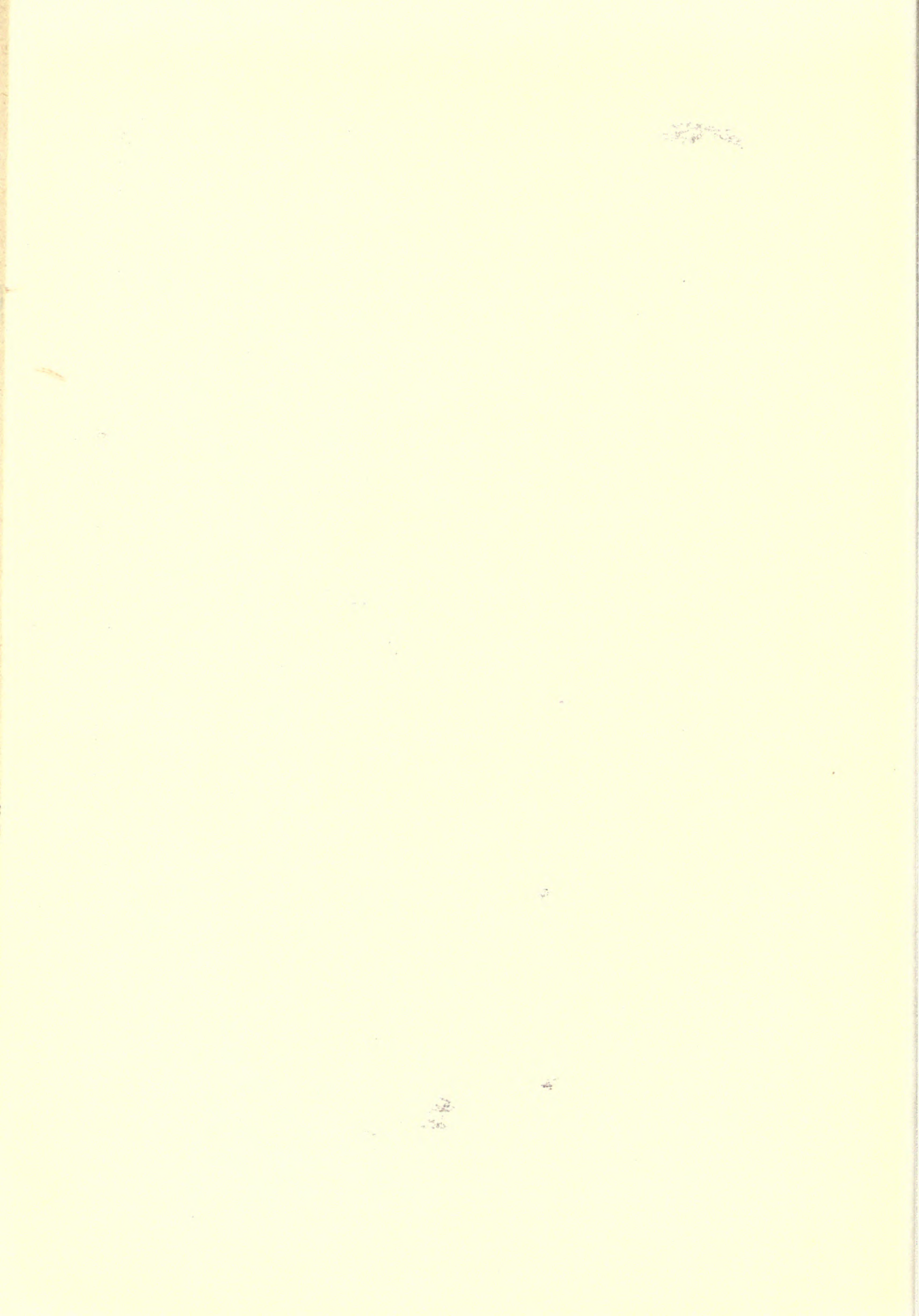
Special branch
of agricultural
department.

Agreements
with Etawah
landowners for
the management
of their waste
lands.

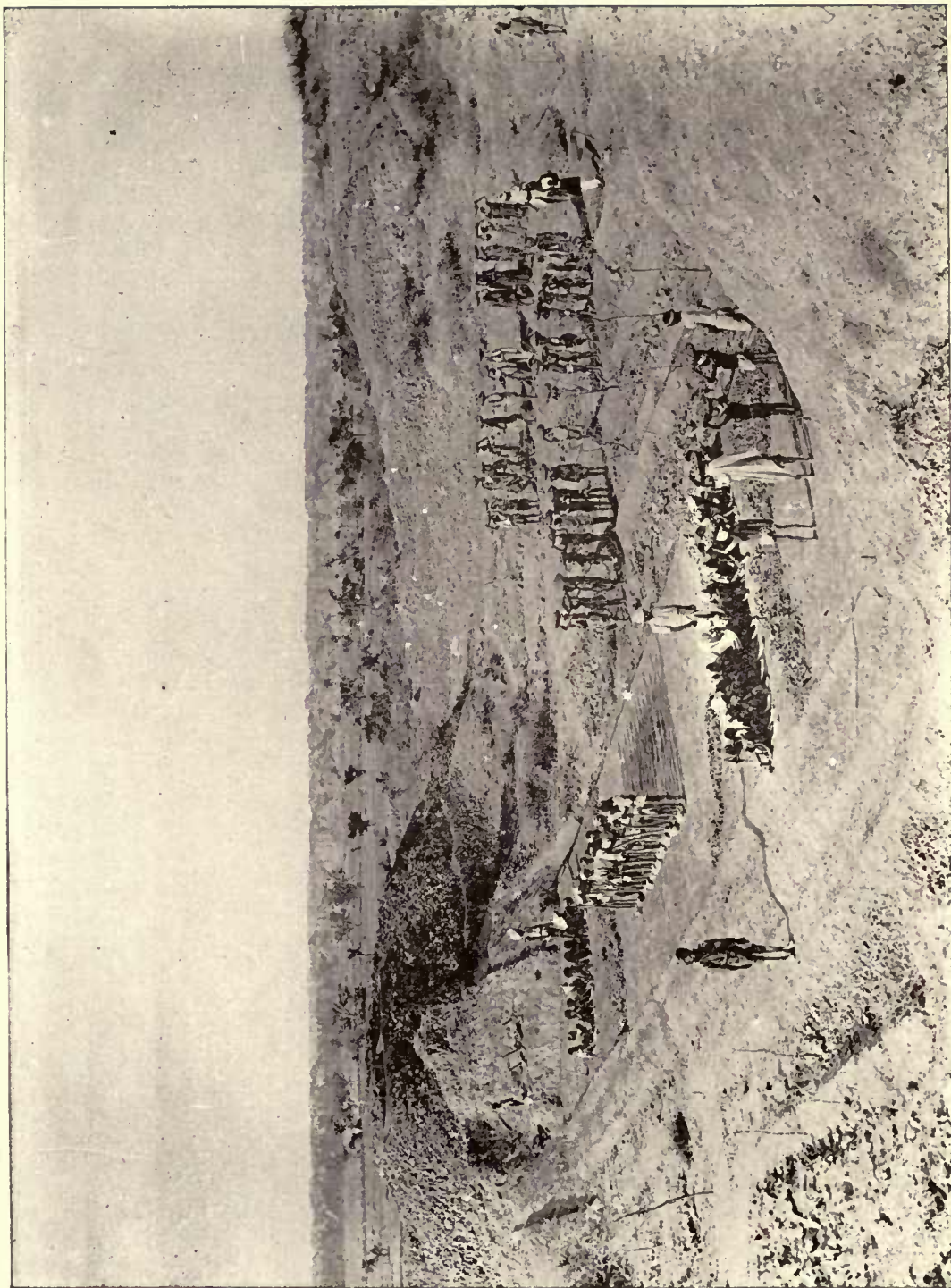


Photo, by Emythias.

Famine labour making ridges and ditches on a steep slope.







Famine labour employed on bandh construction.

1915. For convenience of management the Fisher Forest (2,912 acres) at Etawah was transferred to this division, and 22,004 acres of privately-owned land were finally accepted by the department as suitable. The terms of the agreements were the subject of special meetings at Naini Tal on the 4th October, 1915, and at Lucknow on the 14th March, 1919, and at both meetings it was urged that they should be so framed as to give the landowners an early return and so offer a further inducement to others to offer their lands for management. At the latter meeting, at which the Lieutenant-Governor presided, the existing agreement was criticized as being unnecessarily severe and requiring revision and it was agreed that there was ample scope for both the Forest and Agricultural departments in these provinces but that they should work in separate areas. It was suggested that the Forest department should work principally in the Agra and Etawah districts, while the Agricultural department should interest themselves in the ravines of Bundelkhand. The provision of breeding grounds should not be lost sight of.

Afforestation
conferences.

The terms of the existing agreement are, at the time of writing, under revision allowing the owners a minimum rent of 8 annas per acre on the reclaimed land until the plantations mature and pay a higher return. The proposition is justified on the grounds of insurance against famines, saving of valuable country from erosion, improvement of agricultural amenities, and reclamation of waste and worthless land, as well as making it a popular measure with the owners.

The existing experimental blocks were extended (1916) by the addition of 29 acres situated in the Ganges Khola of the Meerut district (appendix XII) and the further extension (125 acres) of the Allenbagh Experimental plantations at Cawnpore (1917) through the generosity of the late Mr. G. B. Allen, who provided Rs. 20,000 to meet the cost of acquisition. Owing to the depletion of staff during the Great War the Afforestation officer was placed in charge of the Etawah division in addition to his main duties and further extensions, for similar reasons, became impossible. The scattered nature of the experimental blocks and their small size was opposed to economic management and the work of covering such a wide stretch of country (five districts) being too

Meerut and
Cawnpore experi-
mental plots.

The Kalpi and Piprayan plantations belonging to the Ordnance department were taken over by the United Provinces Government in 1915 on the following terms:—

- (a) That the cultivation of the babul under the supervision of the Forest department would be encouraged to the fullest extent possible; and
- (b) That the Harness and Saddlery Factory, Cawnpore, should have the first claim on all bark from such cultivation at the market rate prevailing at the time of supply. (Vide letter no. 4304/(O-5) of 26th September, 1914, from the Secretary to Government, Army department, to the Chief Secretary to Government, United Provinces.)

great a strain to impose on a single officer, it was decided to transfer the babul forests in the Hamirpur district to the newly formed Banda division and to merge the Etawah division once again into the Afforestation division. This took effect from the 1st July, 1918 (G. O. no. 251/XIV—32, dated the 26th March, 1918).

Improvement
trusts.

In 1919 the Improvement Trust at Cawnpore intimated their intention of acquiring a stretch of land adjoining the Allenbagh plantation which they desired to be afforested at their expense through the Forest department.

Similar action has been taken by the Lucknow Improvement Trust.

It has been proposed, for the future to extend work, firstly in those localities near towns or railways where good profits are assured, secondly in those more distant areas where financial expectations are fair as, for instance, the Etawah district ravines along the Chambal and Jumna rivers, and thirdly, except as works of ravine-reclamation or insurance against fodder famines, in those more remote and inaccessible areas from which direct financial returns are hardly to be expected.

Since going to press orders have been received from Government regarding the future policy to be observed in the extension of afforestation operations. These orders have been added as the last two appendices to this book.

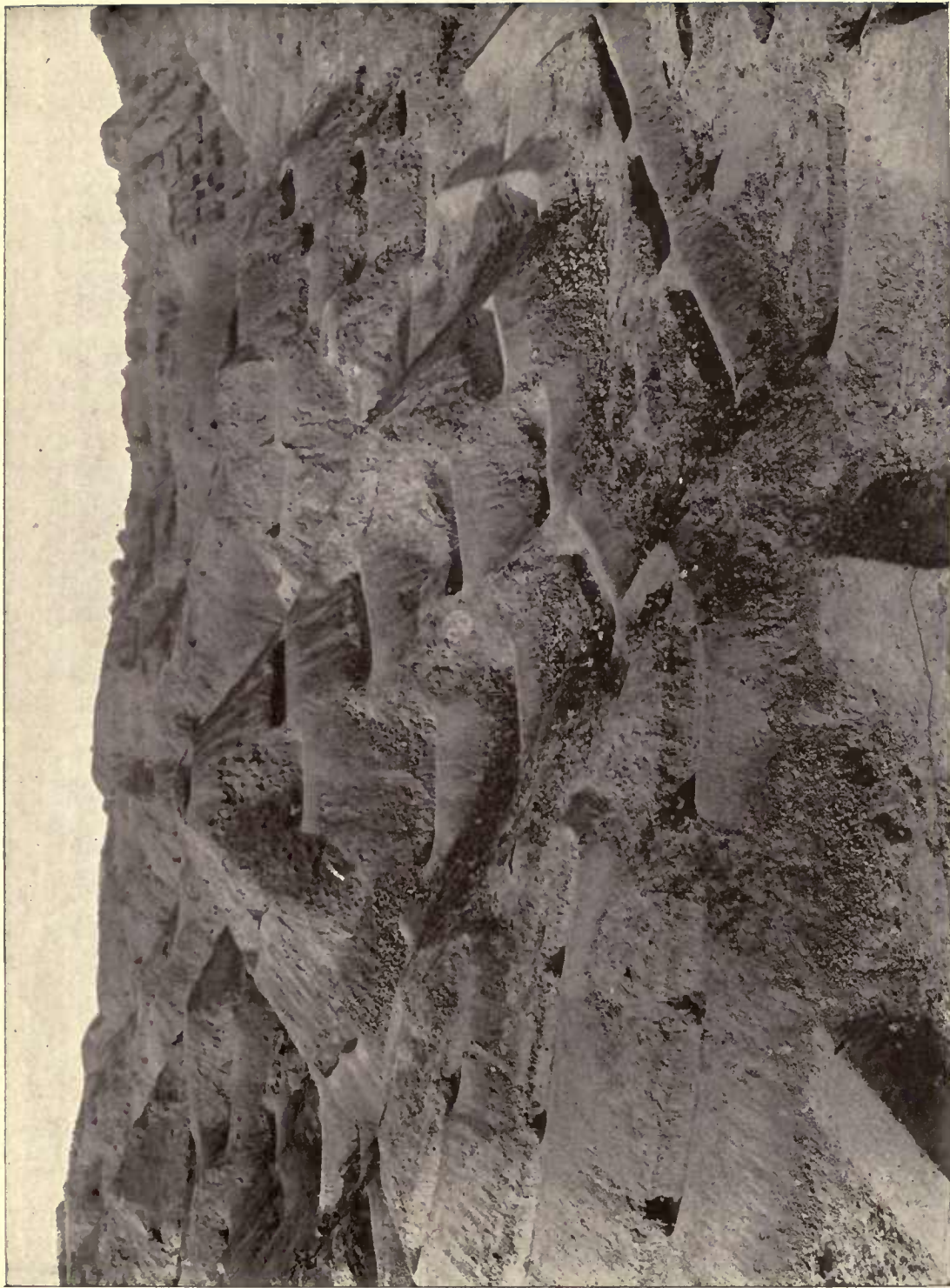
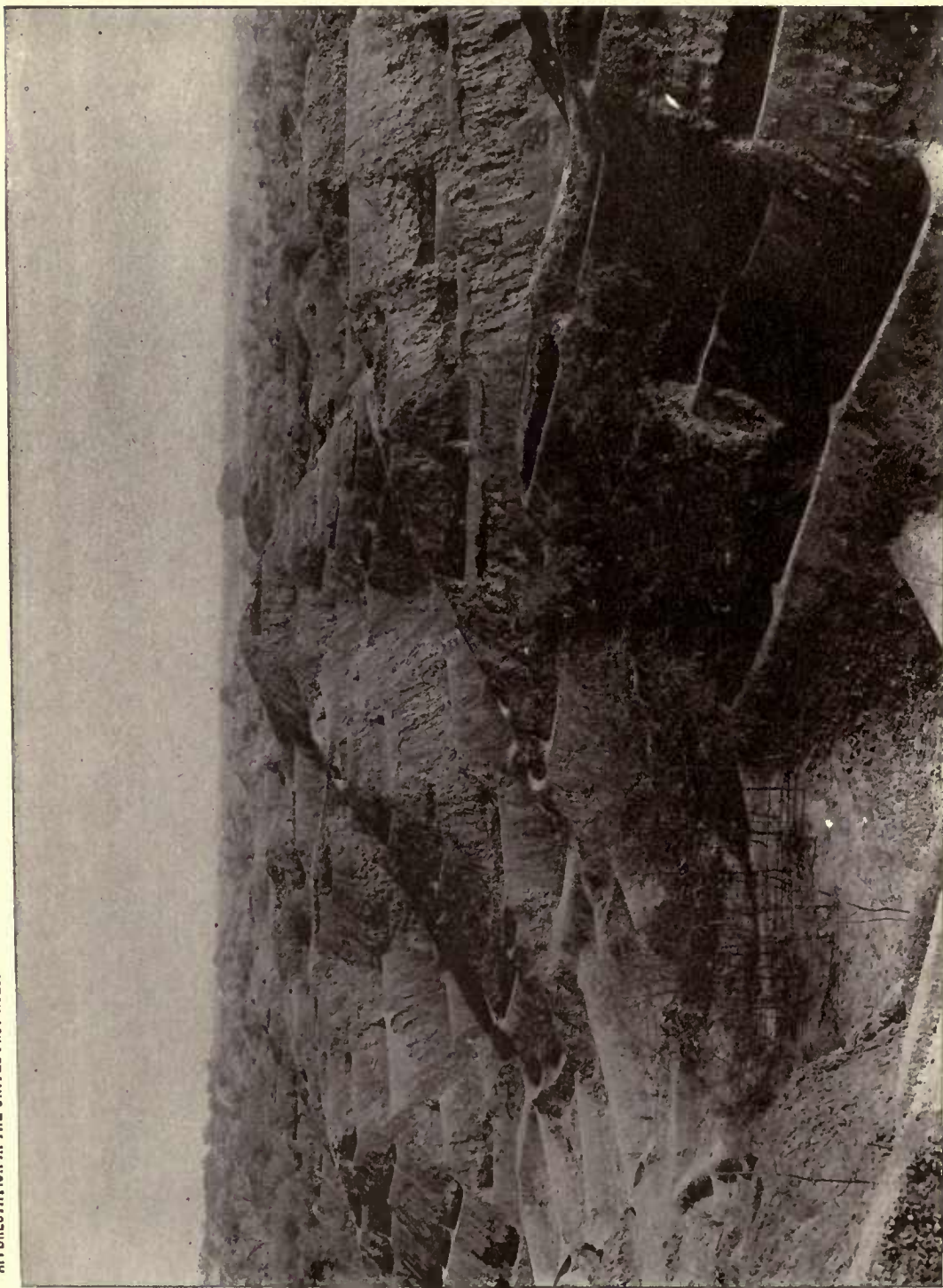


Photo. by Smythies.

Illustrates soil preparation on moderate slopes with ridges and ditches. Ready for sowing.



Typical ravine country with soil preparation completed by famine labour. A bandh with 3-years-old Babul in foreground.

Photo. by Smythies.

Chapter IV.

THE METHOD OF AFFORESTATION.

The soil of the ravine areas may be classed as a sunbaked loam, usually sandy, but differing in consistency from place to place. There is usually a thin upper layer of *kankar*, in nodular form, left behind by the mechanical action of water and, owing to the continuous tread of cattle and the baking of the sun, the top few feet are exceedingly hard and impervious to water which runs off readily to the main rivers. The areas are almost treeless; the following species are found in scrubby form, and there is a notable absence of regeneration except by coppice shoots:—

Soil-cultivation.

- (1) *Capparis aphylla*, (2) *Carissa Carandas*, (3) *Carissa spinarum*, (4) *Adhatoda Vasica*, (5) *Balanites Roxburghii*, (6) *Zizyphus jujuba*, (7) *Prosopis spicigera*, (8) *Acacia leucophloea*, (9) *Acacia arabica*.

The grass crop consists almost entirely of the worthless species, *Aristida adscensionis*. The first object of management in a work of this description is the re-establishment of conditions sufficiently favourable for vegetation. The ordinary system of planting in pits and sowing in hoed-lines, although eminently suitable in other places, is bound to fail in the ravines. It is necessary to repair the damage of centuries by the efficient working of the soil and the conservation of the maximum amount of moisture. The actual soil is, it is believed, fertile enough for most trees found in similar latitudes after the requirements of moisture and aeration have been satisfied. The most satisfactory means so far discovered of effecting this improvement is the breaking-up of the compact surface soil, either by deep ploughing or hand digging, thus aiding the gaseous exchange between soil and air and allowing the penetration of moisture into the subsoil. It is also necessary to preserve the continuous gaseous interchange and to prevent further consolidation. Soil-cultivation extended over several years is impracticable in a forest estate owing to the low final returns and could only be carried on for two years at the most even if only valuable species were raised. It is however known that if once a forest plantation can be established, the actual trees themselves by means of their roots, litter and shade will keep the soil in condition. It is found that Ransome's S. B. plough, obtainable from Messrs. Octavius Steel & Co., Calcutta, is about the most effective instrument for this work, it is strong, light, and works the soil to a depth of eight inches; other ploughs, although useful for certain work, are not suitable for the rough initial work of breaking-up the top soil. In many portions of the ravines the

terrain is far too steep to employ ploughs and here the work has to be done by hand and in some places the sides of the cliffs are too precipitous to be worked at all. Ploughing should commence in October and, if possible, be completed before the hot weather; usually only one ploughing is resorted to. To serve the purpose of seed beds and to hold up the rain-water in pools alongside the future seedlings, contour ridges are constructed of broken earth measuring roughly two feet wide and one foot high and connected at intervals with cross ridges to localize damage from water breakage. Furthermore, dams are constructed at suitable intervals from the heads of the ravines downwards, to hold up all surface water flowing from the upper levels: in this way a very large amount of rain-water is conserved during the critical stage of germination and sinks into the ground instead of running to waste. It is found by experience that as soon as grass and tree-growth is established all run-off practically ceases. The fixing of sites for the dams requires considerable experience, the cheapest sites are usually the worst in practice, everything depends on the position of the waste water escape which should be a natural one if possible. Below is given a diagram of a dam or *bandh* with certain specifications:

- (1) The bed of the ravine to be cleared of *kankar* and *bajri*
- (2) The escape drain to be dug out first and the earth to be thrown on to the *bandh*, surplus earth required to complete the *bandh* to be removed from the high land on either side of the ravine.

- (3) The earth in the *bandh* to be completely broken up with wooden hammers and consolidated

- (4) The depth of the escape should be so arranged as to allow water to overflow at two-thirds the height of the *bandh*.

- (5) The escape should be at least 10 feet wide at the bottom, with an inner slope of 1 : 1.

- (6) The depth of water behind any *bandh* should be so regulated as to prevent it reaching the toe of the proceeding one.

- (7) The height of the *bandh* should be one-half times the depth of water, if the depth of the water is four feet, the full height of the *bandh* will be $4' \times 1\frac{1}{2}' = 6'$.

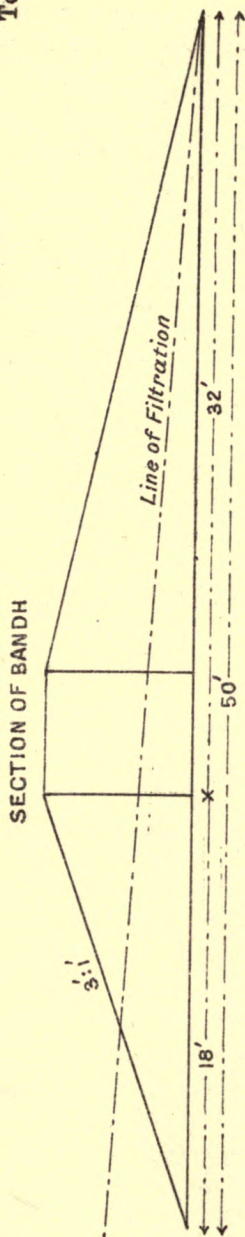
- (8) The minimum top width is five feet.

- (9) The bottom width to be equal to three times the height of the *bandh* plus eight times the depth of water in the *bandh*. Suppose the height of *bandh* to be 6' and the depth of the water is 4', then the bottom width $6' \times 3$ plus $4' \times 8 = 50'$.

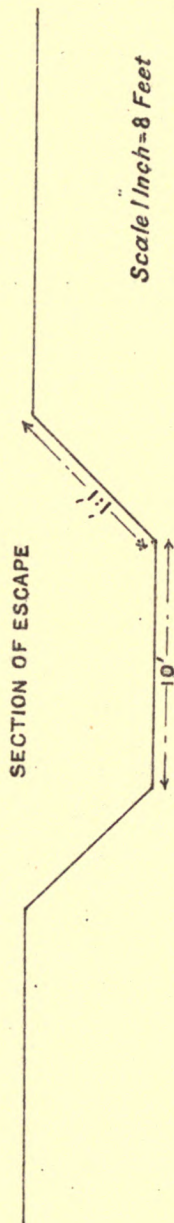
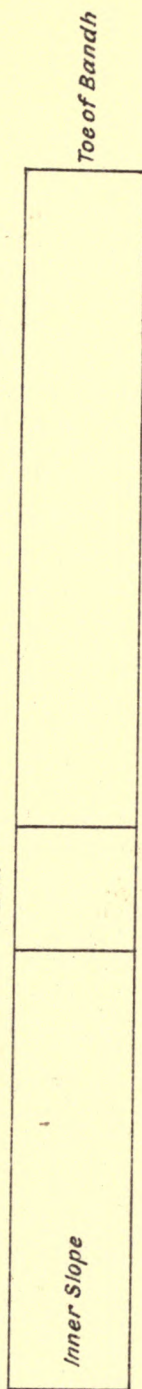
- (10) The inner slopes of the *bandh* should be 3 : 1.

- (11) After finding the top, bottom width, and inner slope of *bandh*, the outer slope will be ascertained by itself.

To face page 20.



PLAN



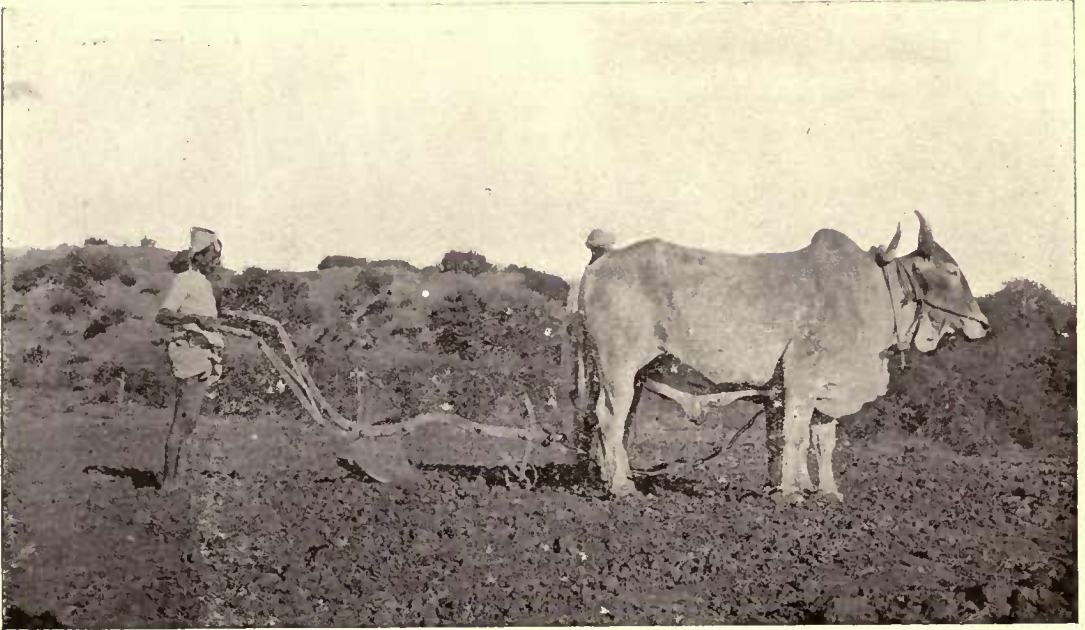


Photo. by Cox.

Ransomes S. B. plough which is the most efficient implement for ravine work.



Mild ravine land ploughed and sown with shisham 4 years old.

- (12) The line of the filtration should not be less than eight times the depth of water in ordinary soils and four times the depth of water in very good soils.

Another system of soil-preparation that has given very good results is the ridge-and-ditch method. Ditches are dug contourwise, usually two wide and one deep, and the earth from the ditches heaped up in a ridge on the downward side to form a seed bed: the foundation of the ridge must be well dug up before starting the making of the ridge. The ditches should be *bandhed* at intervals to prevent side flow. The advantage of this system is that a large quantity of water from the unworked ground is collected in the ditches alongside the plants. The ditches require great care in alignment, as otherwise they may drain off the water instead of conserving it.

Under this system grass comes in very slowly on the unworked ground between the ditches, but the tree-growth is undoubtedly more rapid than under other systems.

So far the systems of soil-cultivation in the ravines have been dealt with; a certain amount of experience of afforestation on entirely different soils has, however, been gained. The Hamirpur babul areas offered quite a different problem; here the soil was of the water-logged black cotton variety with no defined drainage direction: sowings on ground level were invariably swamped and the only system which succeeded at all was to sow on ridges above the water level. In places this succeeded, but generally the tall grass-growth, floods, and the hardness of the soil on drying destroyed the work. A drainage scheme was eventually started and attempts were made at ploughing the very hard ground; this resulted in a little more success, but further experiments were suspended by the transfer of the areas to the Banda division.

Ravine-reclamation has been found by practical experience to be eminently suitable for famine labour. Practically every class of labour is catered for, the work can be closed down at any time without leaving it incomplete and owing to its shifting nature it is far healthier than the usual run of famine works. In the Etawah district famine (1918-19) ravine-reclamation formed the backbone of relief and gave employment to 1,253,706 units. A full account of these operations is given in appendices XIV and XV.

Famine labour
for afforestation.

Of all the indigenous trees found on the area, babul seemed the most attractive by reason of the demand for its bark at the Cawnpore tanneries and wood for fuel and small agricultural requirements. In the absence of any knowledge as to what species would grow in the ravines, it was natural that babul was selected in the first instance. Experiments, however, were carried on simultane-

Choice of species.

ously with a variety of other species, both by planting and direct sowings, a list of these is given below :—

- (1) *Acacia arabica* by sowing *in situ* and planting in the cotyledon condition.
- (2) *Dalbergia sissoo* by sowing and planting.
- (3) *Dalbergia latifolia* ditto.
- (4) *Gmelina arborea* ditto.
- (5) *Melia Azedarach* ditto.
- (6) *Bombax malabaricum* by sowing.
- (7) *Tamarix indica* ditto.
- (8) *Pongamia glabra* ditto.
- (9) *Albizzia moluccana* by planting.
- (10) *Albizzia procera* by sowing.
- (11) *Bassia latifolia* ditto.
- (12) *Eucalyptus bicolor*, *Eucalyptus citriodora*, *E. Botryoides*, *E. collosea*, *E. cerebrae*, *E. focundae*, *E. globulus*, *E. jugalis*, *E. leucoxylon*, *E. melanoxylon*, *E. mycrophylla*, *E. melliodora*, *E. occidentalis*, *E. paniculata*, *E. robusta*, *E. rudis*, and *E. tereticornis* by planting.
- (13) *Eugenia jambolana*.
- (14) *Grevilla robusta*.
- (15) *Inga dulcis* by sowing and planting.
- (16) *Salix babylonica* by planting.
- (17) *S. tetrasperma*.
- (18) *Holoptelia integrifolia* by planting and sowing.
- (19) *Adina cordifolia* by sowing.
- (20) *Trewia nudiflora*.
- (21) *Lagerstræmia parviflora* by planting.
- (22) *Morus indica* by sowing.
- (23) *Acacia catechu*.
- (24) *Hardwickia binata*.
- (25) *Piptadenia oudensis* by planting.
- (26) *Bishoffia javanica*.
- (27) *Tectona grandis* by sowing and planting.
- (28) *Casuarina equisetifolia* by planting.
- (29) *Schleichera trijuga* by sowing.
- (30) *Diospyros melanoxylon*.
- (31) *Bauhinia malabarica*.
- (32) *Shorea robusta*.
- (33) *Terminalia tomentosa*.
- (34) *Terminalia belerica*.
- (35) *Terminalia chebula*.
- (36) *Buchanania latifolia*.
- (37) *Hymenodictyon excelsum*.



A babul plantation 2½ years old at the head of ravine.
Etawah district.



Photo. by Cox.
A babul plantation 3½ years old at the bottom of a ravine.
Etawah district.



Ravine land before planting.



The same land 5 years later.

- (38) *Mallotus philippinensis*.
- (39) *Cassia auriculata* by sowing.
- (40) *Cassia fistula* by planting.
- (41) *Ficus glomerata* ditto.
- (42) *Cordia myxa* by sowing.
- (43) *Dendrocalamus strictus* by sowing and planting.

Of these species *Acacia arabica* has been found to be the best species for sowing on the higher levels and slopes and *Dalbergia sissoo* for sowing and planting in the lower moister levels. If this species is planted, the stems should be cut down to 1" and 4" above and below ground respectively. Of the other species *Tectona grandis* (teak) is perhaps the most satisfactory; the germination of this tree is however difficult and it is recommended that the seed should be scorched in a fire before sowing, but even this does not cause all the seed to germinate in the first year. The soil of the sowing areas should be very carefully prepared, kept entirely free from weed-growth and the top soil loosened at frequent intervals. It is recommended that teak should be sown broadcast in selected flat areas only, where the cultural operations can be easily done.

Gmelina arborea has been very successful in most areas where it has been sown. The wood is good and its uses the same as the English beech. It is best raised by direct sowings in lines on ridges, the upper levels being the best as the tree suffers from frost.

Albizia procera and *Hardwickia binata* has been fairly successful in the moist and low-lying localities, but so far these species have been tried on a very limited scale.

Bamboos (*Dendrocalamus strictus*), transplanted after one year in the nursery, have given moderately good results.

Holoptelia intergrifolia, a tree of importance in turnery, has been tried on a small scale with very fair success on the upper levels of the ravines.

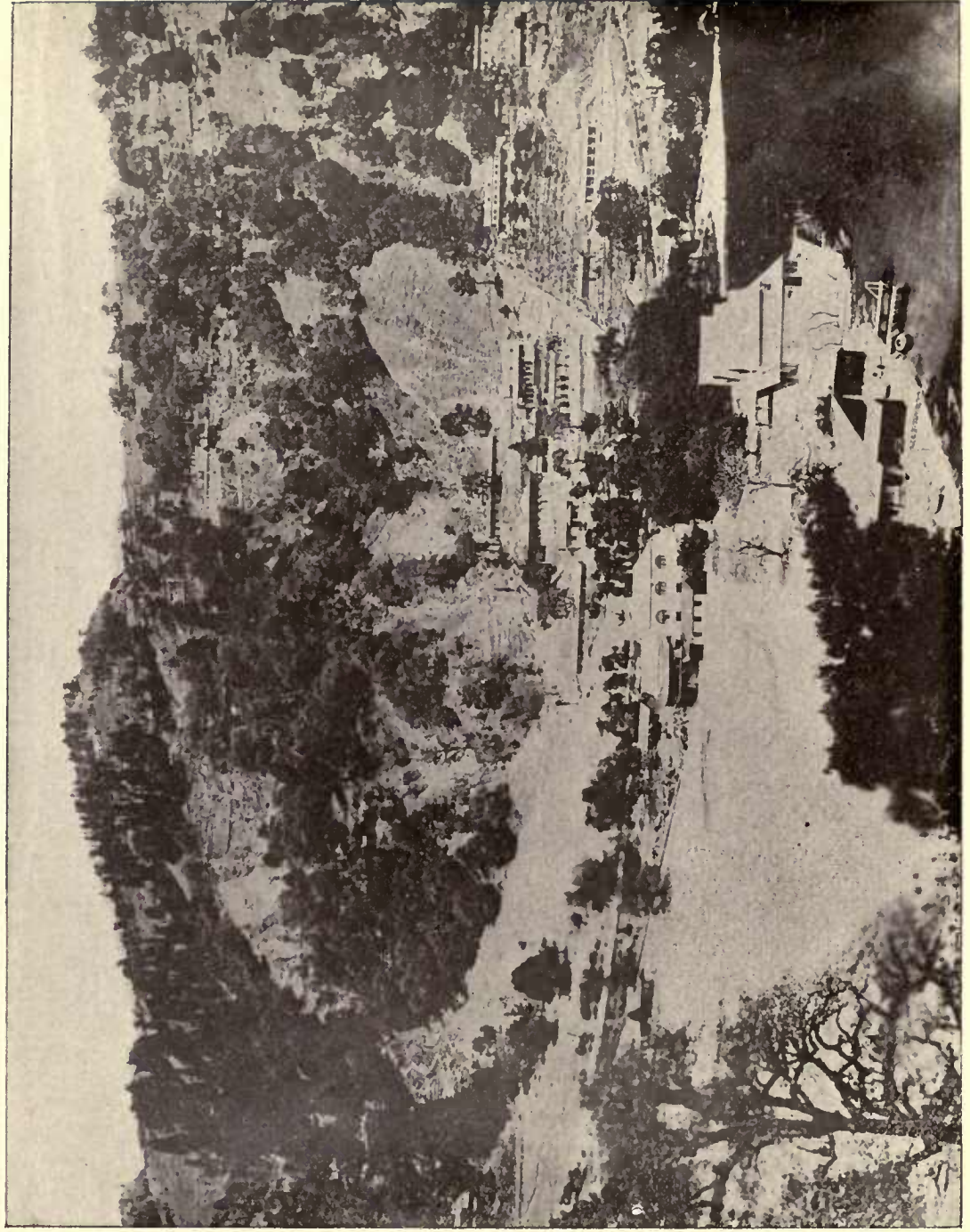
Of the other species the following may be mentioned as being suited to ravine soils but, being of little economic importance, they need only a passing reference, *Pongamia glabra*, *Inga dulcis*, and *Cordia myxa*.

The following species although suited to the ravines are invariably damaged by porcupines and hares: neem (*Melia indica*) and semal (*Bombax malabaricum*).

The importance of keeping the soil round the plants entirely clear of weeds and in a loose condition cannot be overestimated. For the successful establishment of a plantation in the ravines tending operations have to be ceaselessly carried out during the

first monsoon months, July to October, if this is not done, the results invariably end in failure.

Cassia auriculata.—Tarwad, a shrub which came into prominence during the war as a tanning material, can be raised very easily on ploughed land of the ravine type. It seems to require very little attention and stands quite severe drought too. In the Etawah district several hundred acres have been sown between the lines of trees as a catch crop. It suffers however from frost and it is doubtful whether its cultivation will be profitable.



The China hillside Naini Tal before the landslide.

Chapter V.

FINANCIAL

It has been stated that a fair comparison can be drawn between the reclamation of ravines and the reclamation of the sand dunes in the neighbourhood of Bordeaux—Les Landes—in France. It is almost inconceivable that the French Government of about 100 years ago can have hoped to establish valuable coniferous forests on those vast stretches of apparently pure silver sand, but the *Government did realize that it was possible and necessary to check the encroachment of the sand on the inland cultivation.* Accordingly the French forest department began to hold up the shifting sand by planting tufts of coarse grass and when these were buried the forest officers planted more. It is easy to imagine the despair of those officers at the apparent hopelessness of their task, but they persevered and in the end their patient efforts overcame the forces of Nature. The shifting sand was fixed and they began to sow seed. On what was once a rolling waste of sand now flourish dense pine forests, in which the peasants find ample work for themselves and pasture for their cattle, and behind the shelter of which they cultivate their fields in security.

The work still goes on, more and more sand is reclaimed, and it is noteworthy that here, as in other different localities, the French forest department is content to go on preparing the ground for future afforestation for 20 or 30 years before planting any trees and without looking too closely into the direct financial possibilities.

So far the Government has not viewed ravine reclamation by afforestation in the same light and every scheme has to be supported by prospects of remuneration. The cost of ravine reclamation is expensive and in order to render it directly profitable the areas must be well situated for the sale of the produce. It is doubted whether the establishment of fuel and fodder reserves in the ravines would be a profitable undertaking except in very favourable localities near towns, unless a certain amount of big timber was produced increasing in amount according to the distance. Fortunately it has been found that shisham, a tree for which there is almost unlimited demand, grows excellently and without difficulty. It must also be remembered that the whole of the area in which the ravines occur is a danger zone in famine years, depending for the preservation of the cattle on the carriage from outside districts of hay over long leads by rail and rough roads. These famines occur on the average about once in every five years. The ravines after treatment yield excellent hay and even in dry years the crop has been known to yield 10 maunds per

acre, besides good grazing. The direct saving to Government from home-grown hay would amount to no less than Re. 1-8 per maund, and should be taken into account in the financial expectations.

During the last famine (1918-19) there was considerable delay in importing fodder owing to transport difficulties; such delays, with their attendant dangers, would be avoided in the case of local supplies. In the Etawah district as a result of these delays and the general scarcity of fodder 40,000 cattle died, while nearly 200,000 animals disappeared from the Agra district. It has time and again been suggested that hay should be cut and stored in normal years, when the demand is small, to meet famine emergencies. This proposition has, so far, not appealed to Government owing to the fear of loss from deterioration in the stack. There is no doubt that considerable quantities of hay have been lost in the past by careless stacking and for this reason it is suggested that permanent barns should be built to protect the hay from the weather.

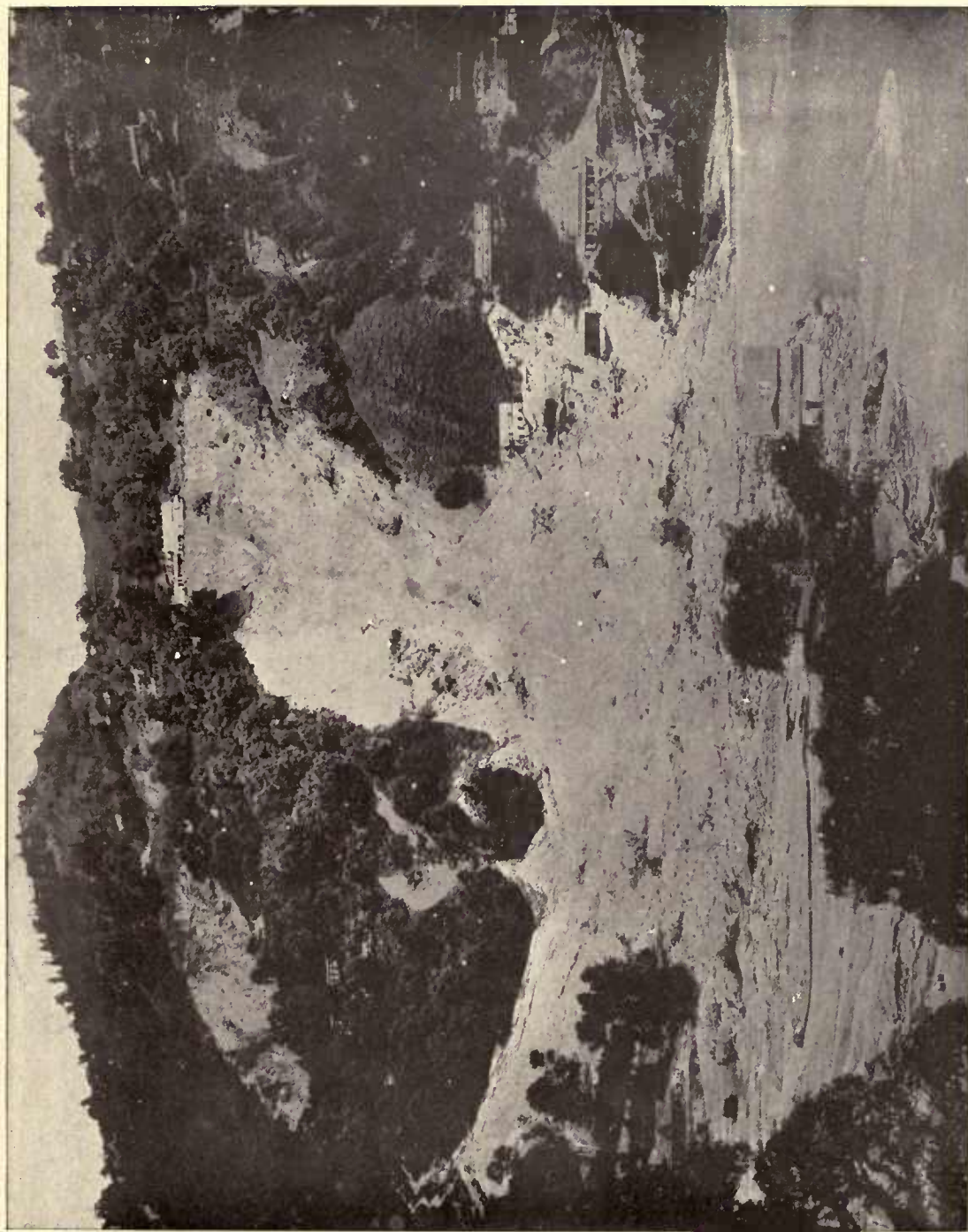
All indirect benefits such as the saving of valuable land from erosion should also be balanced against the cost.

The chief sources of revenue will be (1) grass, (2) timber, (3) fuel, (4) grazing, (5) minor forest produce.

Definite figures of cost are available; in three years 2,007 acres of plantations have been established at a capitalized (4 per cent.) inclusive cost of Rs. 1,27,645, or about Rs. 64 per acre. This figure is very much inflated by addition of the full depreciation on buildings, fences, and surveys common to the whole division.

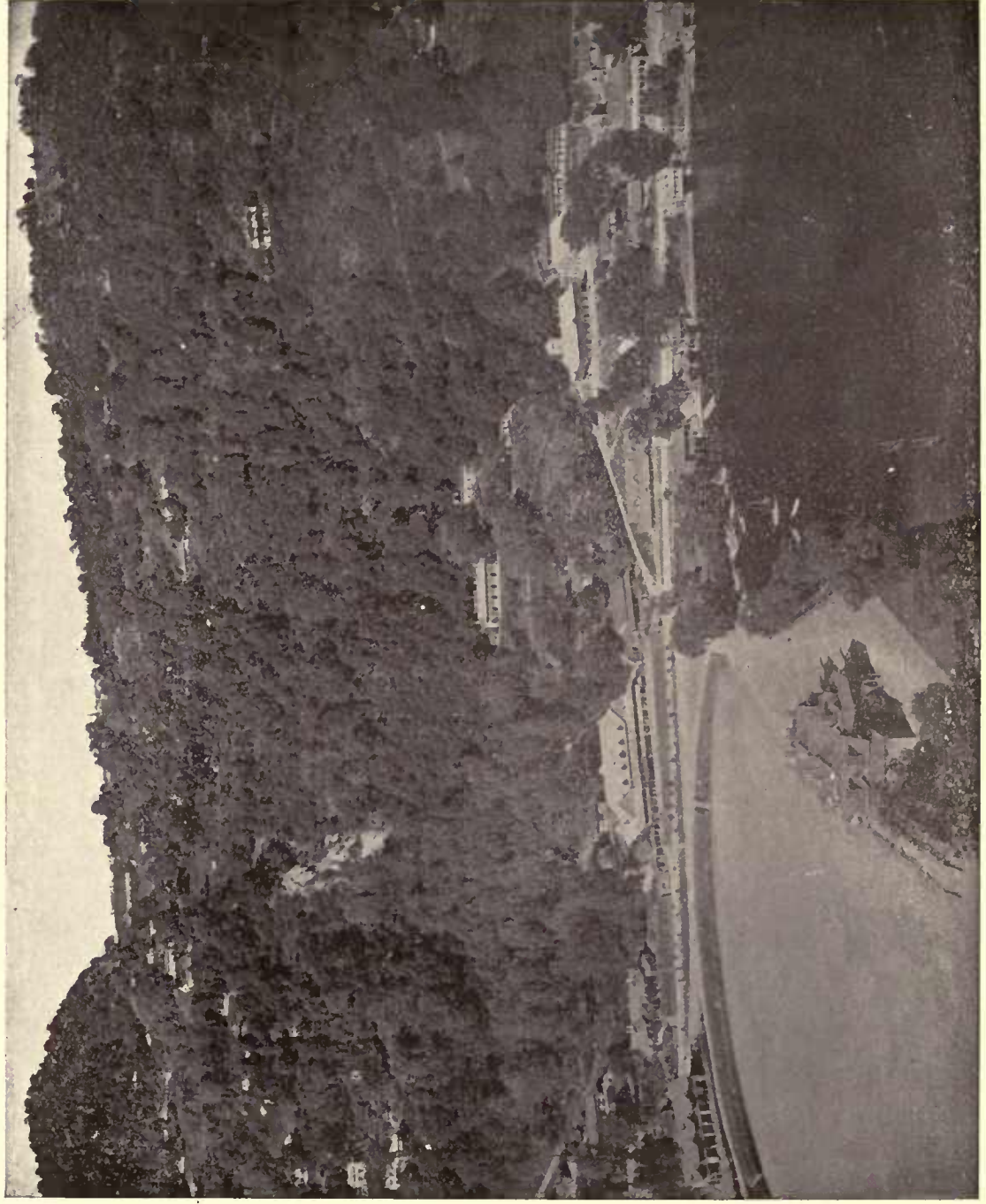
Mr. Smythies, Deputy Conservator of Forests, who was in charge of the Afforestation division for a short period during the writer's absence on leave, has drawn up an interesting memorandum showing, as far as can be anticipated, the financial prospects. His figures although conservative, show that by introducing timber trees, either as standards over coppice or in special portions of each block, it is possible to pay off not only all the capital expenditure (accumulated at 4 per cent.) after 40 years, but also to yield a very substantial surplus. These figures appear as appendix XIII, but it should be remembered that the data on which any forecast can be based are at present almost entirely hypothetical.

It is not to be supposed that the whole capital can be repaid at the first or even any subsequent felling of the forest crop. The heavy initial expenditure is incurred on establishing a forest which, with proper care and management, will last for ever, reproducing itself naturally without further outlay. It should therefore be sufficient if the interest be repaid and the capital left on the ground. Existing plantations situated close to towns, such as Etawah, Kalpi,



The China landslide, 1880. One hundred and fifty persons were killed.
This accident was largely attributed to the clearance of the forests on the hillside.





The China hillside in 1920 showing the result of planting and protection from grazing.

and Cawnpore have, almost from the beginning, paid off the annual interest charges on capital through the sale of grass and other minor forest produce. In other more remote localities the interest charges (4 per cent.) may not be met until the tree-crop matures and possibly not till after the first or second rotations. There are also areas so remote and difficult of approach where financial results are problematical and these should be treated quite apart from any consideration of direct profit. The use of the rivers for transport will no doubt be a very important factor and experiments should be made to ascertain if this form of export is practicable.

For the benefit of those who may be considering the establishment of forests on lands similar to those already described, the following schedule of rates, usually paid in the Etawah and Jalaun districts, is given. Near big towns the rates are about 20 per cent. more :—

Cost of creation and upkeep of ravine plantations.

The following general rates are sanctioned in the Afforestation division :—

I.—Soil-preparation—

- (1) Ploughing on flat or undulating ground, Rs. 3 to Rs. 4 per acre.
- (2) Making field ridges on ploughed land, Rs. 6 per acre.
- (3) Making ridges with ditches on unploughed land, steep slopes, etc., including little cliff-breaking, and breaking down bumps, pinnacles, etc., Rs. 20 to Rs. 24 per acre.
- (4) *Bandh* construction, Rs. 5 per acre or per 1,000 c. ft.

II.—Sowing (including collection of seed), Re. 1 to Rs. 2 per acre.

III.—Tending and weeding in first rains, each weeding Re. 1-10-6 per acre, or with three weedings, Rs. 5 per acre.

Filling up gaps with shisham cuttings and other transplants : planting grass roots, etc., annas 10 to Re. 1-5 per acre.

IV.—Subsequent tending and miscellaneous—

Tending (two to four years old), annas 8 per acre.

Fencing with thorns, annas 6 to annas 9 per acre.

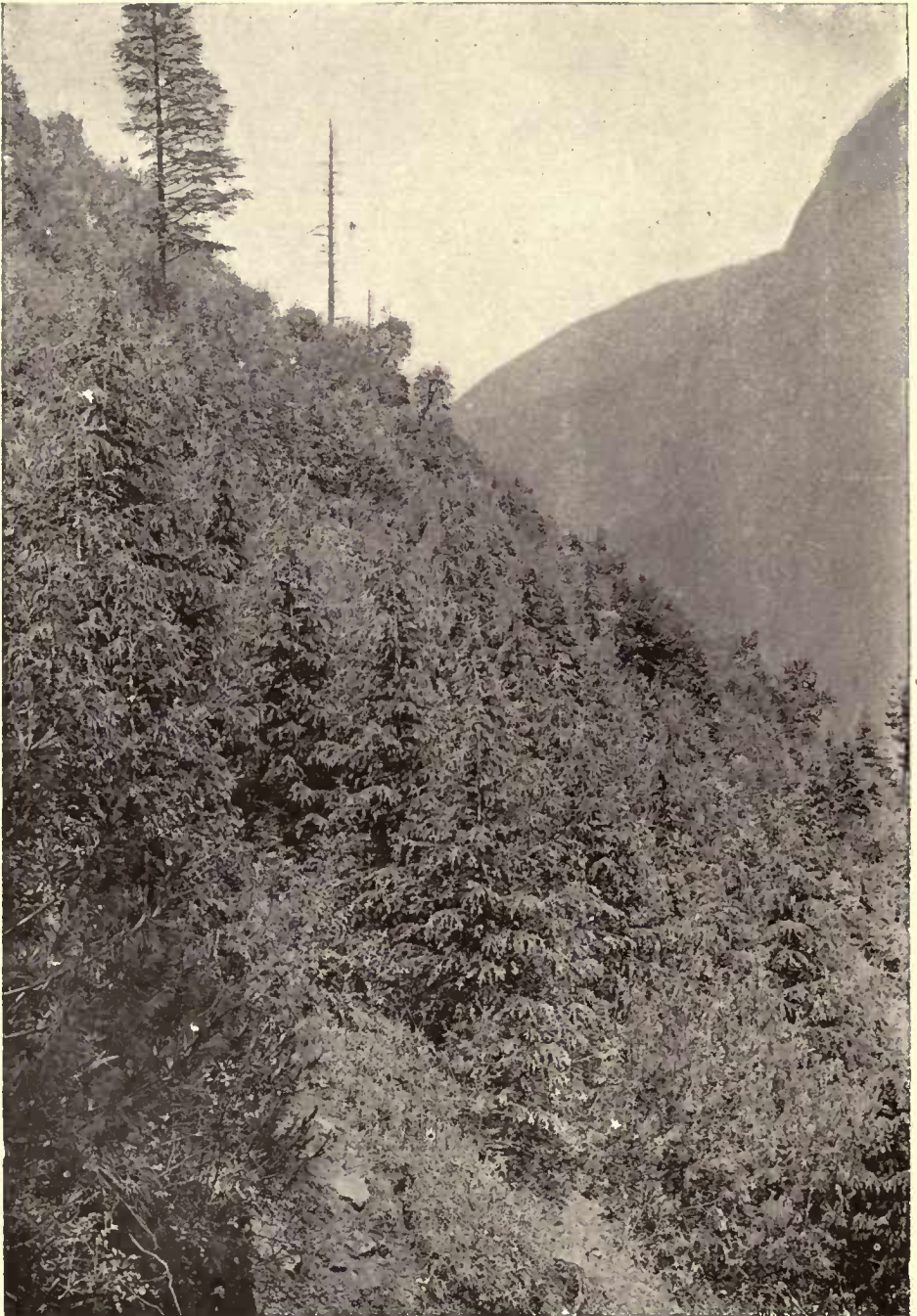
Cattle guards and forest guards, annas 8 per acre per annum.

The general cost of creation and upkeep of plantation excluding—

- (1) Acquiring the land and preliminary demarcation.
- (2) Wire fencing.

(3) Over head and supervising charges, may be put roughly as follows :—

	(a) On flat lands without <i>bandhs</i> per acre.	(b) Moderate- ly ravined lands with <i>bandhs</i> per acre.	Remarks.
	Rs. a. p.	Rs. a. p.	
Soil-preparation ...	10 0 0	25 0 0	Based on actuals for the year 1919-20.
Sowing, tending, and pro- tection for first year ...	8 0 0	8 0 0	
Subsequent tending and filling-up failures ...	0 8 0 per annum.	0 8 0 per annum.	
Miscellaneous recurring expenditure ...	1 0 0 per annum.	1 0 0 per annum.	
<i>Total non-recurring</i> ...	18 0 0	33 0 0	
<i>Plus recurring</i> ...	1 8 0 per annum.	1 8 0 per annum.	



Photo, by Troup.

Afforestation in the Himalayas. A promising 15 year old plantation.

Chapter VI.

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A sal forest. Etawah district had extensive sal forests four hundred years ago.
Now there is not a single tree in the district.

APPENDIX I.

Notes from settlement reports and gazetteers regarding the extent of erosion in the Agra and Bundelkhand districts, United Provinces.

Extract from the final settlement report on the revision of the Jhansi district, including Lalitpur sub-division, by A. W. PIM, Esq., c.s., Settlement Officer.

MOST parts of the district in fact are overdrained. In the high-lying tracts the natural soil is stony and excessively poor. In the more level plains is found the rich deposit which forms the black soil characteristic of Bundelkhand, but in the villages bordering the ravines this is being scoured and broken up by the surface drainage, and the area of good soil is gradually diminishing. The remedy is the construction of *bandhs* or small fields embankment. These the people are familiar with and appreciate and they should be helped by liberal grants of *tagavi*.

The characteristic features of this latter tract are small doabs of black soil lying between a series of ravine-edged *nala* valleys. The most important of these are the Lakheri and Chaich nadis with their tributaries running into the Dhasan through the Mau and Garotha tahsils. Smaller *nalas* run into the Bert or Pahuj through the Moth tahsil. In the latter the general level is much less broken except on the strip bordering on either bank of the Betwa. The soil in the centre of these doabs, when free from scouring, is good *mar*, but the deposit thins rapidly as it approaches the ravines on either side of the *mar*, giving place to inferior *kabar* and finally to the worthless *patri* bordering on the broken ground along the *nalas*.

Ravines and the deterioration caused by them are a subject of serious importance to the whole of the black soil area. They reach their greatest development in the maze of broken unculturable ground along the Dhasan and the left bank of the Betwa, but their destructive influence is still more apparent along the numerous tributary *nalas* which traverse the plains of black soil. In Moth and Northern Jhansi their influence is confined to the neighbourhood of the Betwa, but tahsils Mau and Garotha are traversed by a series of large *nalas* following a roughly parallel course to the north-east and falling into the Dhasan. Commencing from the south, the principal are the Ur, the Sukhnei flowing under the town of Mau, the Lakheru, which after the junction of the large tributaries known as the Dhunderi and Patrehi, passes the villages of Garotha and, lastly, the Chaich

which, traversing the north of Garotha tahsil, flows into the wild broken country known as the "Ghar" at the junction of the Betwa and the Dhasan.

In the Lalitpur sub-division the Betwa has not thrown out many ravines, but the other principal drainage lines the Shahzad, Sanjam and Jamni nadis are not only fringed by wide strips of broken unculturable land, but receive the drainage of a net work of larger or smaller tributary *nalas* traversing the whole of the black-soil area.

The destructive influence of these *nalas* is by no means confined to the land rendered unculturable by them. Their more serious, though less obvious, effect, consists in the gradual thinning of the upper stratum of good black soil which is not being replaced in any way and which must lead to the gradual deterioration of the district, though the process may be a slow one. The evil has been many times pointed out as also has the only apparent remedy, the construction of a series of small *bandhs* such as are found in parts of the Banda district. There are a few good *bandhs* in tahsil Moth and in Northern Jhansi, but elsewhere little has been done, and the only systematic work of this kind undertaken by Government has been at Raksa in the red-soil tract where such *bandhs* are of comparatively little use.

G. O. no. 1428/1-401-1907 of 31st May, 1907.

An important feature is the extent of artificial tanks and lakes. A separate Tanks division of the Irrigation department has recently been formed, and the restoration of old and the construction of new works should make good progress. The importance of the damming-up of ravines to check their destructive influence and of constructing field embankments, to which the Settlement Officer refers, is recognized by Government.

Extracts from the Jalaun District Gazetteer of the United Provinces,
by D. L. DRAKE-BROCKMAN, Esq., C.S., 1909.

The natural divisions into which the country falls are few and clearly marked. Along the outer edge is the ravine belt, fringed here and there, where the contour of the land permits, by strips of rich alluvial soil, but for the most part consisting of low hummocks thickly strewn with kankar and clad with the thinnest scrub or vegetation. The upland which succeeds is composed of light-coloured hard soil, the most valuable properties of which are being continually washed away by the downward flow of the rain-water. Except in the north, the gradual fall in the surface to the level

plain of the centre can be clearly traced by the deepening in the colour of the soil.

In considering the subject of irrigation in this district, however, it must be remembered that retention of moisture in so much of the soil renders a watering in a normal year unnecessary. Besides this the practice of embanking uneven ground has had the effect of protecting considerable areas from the worst effect of drought, especially in the broken tracts along the rivers, where direct irrigation is ordinarily impossible.

The principal river among these is the Non which, traversing the centre of the pargana, strikes the north-east of pargana Orail. The broken land round this river is on an average one-half to a mile wide on either side, and is remarkable for its abrupt declivities and sterility; the soil has in most places been completely eroded by the scour, leaving a rock-like surface of kankar exposed; there are a few fields on the lower level, but these are thickly coated with kankar. Equally destructive is a tributary of the Melunga which runs at right angles northwards through the heart of the pargana surrounded by a deep border of waste land. Smaller streams draining into both are gradually widening the unculturable areas. To the south there are two small streams, the Rayar and Jondhar, which join the Jumna near Kalpi, starting in uneven and undulating, but not actually unculturable, land; they too are flanked by ravines before reaching their destination.

The Betwa valley resembles the Jumna without its fertility.

The drainage of the central tract is supplied by two minor streams, the Non and the Melunga, which flowing north-eastwards unite some eight miles from the Jumna bank and join that river an equal distance to the north of the town of Kalpi. Like the large rivers, they have carved deep ravines which increase in extent the nearer the Jumna is approached, and, as a consequence of their actions, the Kalpi pargana is cut up by a tracery of ravines which have scoured the greater portion of the soil.

Extracts from the District Gazetteer of the Hamirpur district, United Provinces, by D. L. DRAKE-BROCKMAN, Esq., C.S., 1909.

The upper reaches of the Barma river are rocky and lie deep below the level of the surrounding country, but the watersheds terminate few miles from the stream and but little land suffers from the erosive action of its tributaries. After it leaves pargana Rath these begin to be more frequent and form extensive ravines that invade the fertile plains of Muskara and Rath and hardly compensate for the deterioration they cause by depositing occasional patches of alluvial silts.

The Barma river practically divides the district into two equal portions ; the western part is drained by the Parwaha and is much less broken than that to the east. East of the Barma the watershed lies close to that river and there is generally a steeper gradient which is reflected in the more easterly trend of the streams. Though they provide a ready means of escape for the rainfall, which is often heavy in the tract, all these channels are destructive and tend to spread. By denuding the surface soil in hilly tracts and by carrying off the organic matter and other soil-constituents in the level plains, they are constantly and steadily impoverishing the soil, except where the land is protected by embankments.

Extract from the Final Report on the Revision of the Settlement of the Hamirpur district by W. RAW, ESQ., C.S., Settlement Officer (page 1).

The Hamirpur district falls roughly into two parts, the northern portion is flat plain, consisting mainly of black soils except where the land has suffered from the erosion by the numerous streams by which it is traversed. Towards the south the surface rises, the soils, as usual under such circumstances, becoming lighter in character.

The northern portion of the pargana is described by the Settlement Officer as consisting of a series of *doabs*. At a distance from the streams, the soil is a good *mar*; as the streams are approached the soil deteriorates through poorer *mar*, *kabar*, and *parwa* until it becomes worthless *rankar* in the ravines. Some portions of this area have suffered severely from the scouring of rivers and small streams. In the Jalalpur pargana, in which there are unusually larger areas of broken land, only 40 per cent. of the total is normally under cultivation. Most of the numerous rivers by which this part is intersected are surrounded by belts of ravines of varying extent, but within the ravines there are often patches of alluvial soil of considerable value.

The area of ravines is very great and though much worthless land has been, and may be, in the future converted into fertile fields, there undoubtedly remains a large area, which if not absolutely unculturable, would certainly never repay the cost of cultivation. The worst type of ravine, such as is found along the Jumna and in the trans-Ken portions of Pailani, it is probably impossible to reclaim. All that can be done is to prevent their extension by embankments at their heads. The less serious ravines which are found along the smaller rivers, such as the Bagain and its tributaries, are capable of much more extensive improvement, and industrious communities have, by embanking

and terracing, rendered fertile considerable tracts in the southern part of Badausa and other tahsils. This system of improvement needs a considerable amount of labour and capital, and the only castes that are ready to expend both are Kurmis and Lodhis, though occasionally Thakurs have shown some energy in this respect. The lack of population is a serious and standing barrier to the rapid extension of improvements, and almost the whole burden falls on the back of petty proprietors. If the experiments in afforestation now being conducted on similar land near Kalpi in Jalaun are successful, and any species of tree is found to grow on it, the afforestation of the ravine tracts may be of incalculable value to the district in preventing further erosion, increasing the supply of fuel, and improving the grazing grounds for cattle.

Extract from the Agra District Gazetteer of the United Provinces
by H. R. NEVILL, Esq., C.S. (page 13).

The area returned as barren waste in 1904 was 215,796 acres, or 18·27 per cent. of the whole district. This, however, included the area under water, amounting to 28,879 acres and also the land occupied by sites, roads, and the like. The remainder consists either of usar plains, in which the soil is rendered sterile by the saline efflorescences known as *reh*, or else of ravines and rocky hills. The former cover 22,561 acres, nearly half of this being in the Firozabad tahsil and the greater portion of the remainder in Itimadpur, especially in the north-east; while a small proportion is to be found in each of the three western tahsils. The ravine tract is naturally largest in Bah, which has a greater extent of waste than any other tahsil, no less than 35·9 per cent. of its whole area, and next come Fatehabad, Firozabad, and Itimadpur. Khairagarh has a great deal of barren land owing to the presence of the rocky rangers to the south of the Utangan. The bulk of the land thus classified as barren is undoubtedly unculturable and correctly so termed. At the last settlement the amount was somewhat larger, but the subsequent reduction is necessarily confined to the area classed as usar, which apparently comprised some land that was then classified as unfit for cultivation, but which has subsequently been brought under the plough. The difference is really immaterial, for, as will be shown hereafter, there has been concomitantly with an extension of cultivation an increase in the old fallow, a fact which bears testimony to the accuracy of the former demarcation.

APPENDIX II.

Extract from letter no. 39-Camp, dated the 6th January, 1912, from P. H. CLUTTERBUCK, ESQ., Conservator of Forests, Eastern circle, to Chief Secretary to Government, United Provinces.

NEW FORESTS.

THE existing reserved forests aggregate about 4 per cent. of the area of the province (I write from memory). The additional reserves in Kumaun will raise it to 6 or perhaps 7 per cent. This is a very small area and as the country develops, as industries increase and the prosperity of the inhabitants improves, the demand for forest produce, especially small timber, fuel, and grass will become immense. In my opinion therefore it is extremely important that every district of the province should be carefully examined in order to ascertain whether there are any existing forest areas which could be acquired by purchase, or leased, or given over for systematic management to the department in return for net profits and what waste areas are available for afforestation. I think that the importance of having areas to produce small timber, fuel, and fodder distributed over the provinces of paramount importance. Every year it will be more difficult to do this and so a beginning should be made at once.

I would here invite attention to the final paragraph of this Government's letter no. 527, dated the 29th November, 1909, to the Government of India, and I advocate that an officer be at once put on to this work. When his proposals come up it will be time for a decision to be made as to what future action is required. At the present moment the Imperial service cadre in these provinces is temporarily five above strength and so now is the time to devote an officer to examine and report on each district in consultation with the District Officer or better still, if District officers could be asked first what likely areas there are (1) of existing forests and (2) of waste areas for afforestation; then the Afforestation officer could report on details afterwards and it would be known to which parts he should direct his attention.

As to the finance of this matter, I think that the Government of India should be asked to start loans on this account in the same way as loans are taken for irrigation work and that interest only should be chargeable to the Forest department with perhaps a small percentage towards a sinking fund for repayment. This seems to be a simple arrangement and amply justified by the prospective profits. It was in fact suggested by Sir James Wilson,

K.C.S.I., lately Secretary to the Government of India, Revenue and Agriculture department, in a paper read by him before the Royal Society of Arts.

I believe that it is essential for the future welfare and progress of the people of these provinces that some foresight should be used with regard to the safeguarding of well-distributed areas for production of small timber, fuel, and fodder and possibly even for grazing grounds. I think that in such cases no attempt should be made to make profits from such areas, but they should be managed so as to pay their way and the interest and contribution to the sinking fund for the loan. The necessity of fostering agriculture and industries is great now but it will be many times greater in the future when it may be too late to take the necessary action. I am sure that a commencement should be made now.

APPENDIX III.
GOVERNMENT, UNITED PROVINCES.

No. 348.

[RESOLUTIONS.]

FOREST DEPARTMENT.

Dated Naini Tal, the 26th August, 1912.

OBSERVATIONS.—The attention of the Lieutenant-Governor has for some time been directed to the importance for the future development of the province of a defined policy in the matter of the preservation of the wooded areas now in existence, the *reboisement* of areas which have been denuded of their trees, and the establishment throughout the province of well-distributed fuel and fodder reserves.

2. The important bearing of afforestation on the economic problems of the country is not a recent discovery. The first impulse came from Sir Dietrich Brandis, who, in 1873, was already advocating the establishment of the "agricultural forest" and had initiated steps towards the realization of this policy in Ajmer-Merwara. And at the close of his official career it was on his advice that the Madras Government associated the Forest department so closely with the development of agriculture. The importance of the question was recognized in the report of the Famine Commissioners of 1880 and in the resolution of the Government of India of March 1883 dealing with that report, which called attention to the rapid diminution of grazing-lands and wooded tracts in the United Provinces and to the damage resulting from indiscriminate grazing. It was pointed out that thousands of cattle had been saved by the protected grazing of Banda, and that thousands had perished in Jhansi for lack of such protection. Enquiries were suggested as to the practicability of the formation of fodder and fuel reserves. It was ascertained that *usar* land was available in abundance and ravine land in considerable quantities. An outcome of these investigations was the ravine experiments in Etawah and Jhansi and the establishment of canal plantations at Cawnpore, Agra, Roorkee, and other places in the province. In Madras the fact that the State is the owner of waste land and that, owing to the physical character of the country, cultivated land and forest are brought into more constant and intimate contact, rendered the policy of summoning forestry to the aid of agriculture easier of realization.

3. But the value of afforestation as providing fuel and forest reserves found its clearest and most forcible exposition in the treatise of Dr. Voelcker, the Agricultural Chemist deputed in 1890 by the Royal Agricultural Society to report on the possibilities of improvement in Indian agriculture. The formation of fuel and fodder reserves is advocated by Dr. Voelcker as by far the most important of all his recommendations. In one passage he speaks of this as the "one practical measure which calls for the most urgent attention and from which the greatest benefits may be expected to follow." His other recommendations and suggestions he considered of secondary importance compared with this. He pointed out that the two great needs of the cultivator are water and manure. His enquiries showed that the good cultivator will never burn his manure when he can get wood. The export of both crops and manure must tend to the eventual deterioration of the land. The first result of famine is the depletion of the cattle and the further diminution of the manure available. Manure is as essential as water as a safeguard against famine. It ought to be possible by the provision of fuel and fodder reserves to restore the manure to the land and by a resultant increase in cattle food to augment the number of cattle, setting free still further supplies of manure—an endless chain of benefaction. Such a policy would further tend to check the rising cost of cattle-power, a factor which at present bids fair to profoundly modify the conditions of agricultural development.

4. These principles are in their generalized and abstract form indisputable; it is in their application to practice that difficulties arise. Obstacles to the prosecution of a policy of creating fuel and fodder reserves present themselves in connection with acquisition of land and the disinclination of the landholder or the tenant to realize the benefit of postponing his immediate advantage to the interest of his posterity. There is a danger that the constitution of forest reserves may involve the harbouring and multiplication of wild animals which ravage surrounding cultivation, and a further obstacle has presented itself in the necessity for replacing the grazing areas curtailed during the establishment of such afforested areas. Such restriction is liable, unless alternative grazing areas are made available, to react unfavourably on cattle-breeding. Enquiries tended to show that while the cultivator will burn wood in preference to manure so long as free wood is available, it is very doubtful if he will do so when the use of wood means an appreciable sacrifice in money. While admitting the existence of a host of practical difficulties to be encountered in carrying into effect a general scheme of *reboisement*, the Lieutenant-Governor remains

unconvinced that these difficulties are insurmountable, or that they should deter the Government from attacking the problem or from making a survey of the possibilities of an advance along the lines of least resistance. There are many areas of waste land in the province where the establishment of forests cannot affect the interests of high farming or cattle-breeding, and where the main result of such establishment would be to transform tracts which are barren and useless into productive and protective ones.

5. Apart from the direct benefits conferred by wooded areas in the provision of fodder and fuel, their general effects on the countryside cannot be ignored. Although data are not yet available in India whence it can be demonstrated that forests increase the total rainfall, it would appear probable from the investigations undertaken in those countries where the effects of forests have long been observed that they do so operate. It is beyond question that by the diffusion of cooled air they induce a more evenly-distributed and extended precipitation and mitigate the severity of the climate. Their influence on the water-supply of a tract is equally important. The forests regulate the water in the soil and the moisture in the air by retarding evaporation and by retaining rain in the vegetation and subsoil to find its way without erosion into the nearest stream. They accordingly improve the irrigation of a tract by causing an equable flow in rivers and water courses and by preventing floods which may devastate cultivation and which rob the country of valuable soil.

6. There are undoubtedly considerable expanses of land now yielding a bare sustenance to a few cattle which might be transformed into valuable reserves; and it would perhaps not stretch the imagination unduly to conceive a future in which enlightened local bodies should undertake the establishment of such plantations and from them derive and diffuse much benefit. There are in Europe towns and villages which not only draw from their communal forests a revenue sufficient to cover all rates and taxes, but obtain a surplus for division among their inhabitants. It is not impossible that afforestation may prove the most practicable method of restoring fertility to an exhausted soil, and that the agricultural future of the plains may lie in their approach to an ultimate ideal of the rotation of forest and cultivation.

7. The plantations may often have a direct commercial value distinct from the normal income accruing from the sale of wood and fodder. The Fisher forest at Etawah is an instance in point, and forms an excellent example of the successful and profitable conversion of barren ravine land into a plantation, valuable alike to its owners and to the town it adjoins. In 1884 Mr. Fisher, then Collector of Etawah, arranged with nineteen zamindars for

the reclamation as a fuel and fodder reserve of a tract of nearly 3,000 acres close to the town ; of this tract six-sevenths consisted of barren waste largely intersected by ravines. The proprietors were to provide funds for enclosure, the management was to remain in the hands of the Collector and the profits accruing from the sale of grass and fuel were to be distributed *pro rata* among the co-sharers. Grazing was to be excluded, trees, and in particular the babul, to be sown and embankments to be thrown across the ravines. The cost of fencing, plantation and sowing was about Rs. 1,100 and was paid by the zamindars. The Collector spent Rs. 675 in raising embankments. Up to the year 1892 the average annual income from the plantation was Rs. 650. By that year all expenses had been paid off and the zamindars had received Rs. 275 in profits. The timber was then, though very young, already worth more than Rs. 1,000, and the lease for the cutting of grass and collection of dry wood sold for Rs. 900 yearly. It had not then become possible to allow grazing. In 1902 the zamindars, with the Collector's consent, leased the forest to Messrs. Cooper, Allen and Co., for fifty years at a yearly rental of Rs. 1,416 and a cash payment for fixtures of Rs. 5,000. Under the terms of the lease a third of the area was to remain open for grazing. This instructive and successful experiment thus passed out of the hands of the local authorities and landholders, who have no longer a direct interest in its success. It has since been exploited by Messrs. Copper, Allen and Co., for the extraction of babul bark for tanning purposes. It still, however, provides grazing and cheap fuel to the town of Etawah and is said to have mitigated the severity of its climate.

8. With a similarly dual object, agricultural and economical, the Lieutenant-Governor has recently devoted Rs. 70,000 to the acquisition of babul-growing areas in the Hamirpur district. These plantations are intended, on the one hand, to preserve and make available to the tanning industry the supplies of babul bark essential to its existence and incidentally to derive from that industry an adequate income, and on the other hand to serve the interests of the land itself by preventing denudation and erosion, by arresting the cutting-back of ravines and by providing reserves of fodder and fuel. There is so much good land for babul plantations in the Hamirpur district outside the ravine area that it has been determined to postpone extension of this process to the ravine land of that district till funds are available and till the Kalpi experiment has given more definite results.

9. The Kalpi enterprise also owes its inception to the anxiety awakened in the tanning industry by the prospect of diminishing

supplies and rising prices in the case of babul bark. In 1901, at the instance of the Army department and in the interests of the Government Harness and Saddlery Factory, Mr. Hobart Hampden, Deputy Conservator of Forests, was deputed to investigate the problem of growing the babul for the sake of its bark. His report, while accepting the conclusion reached by the provincial agricultural department as to the impracticability of babul-growing in *usar* land, advocated experiments in ravine land and outlined an extensive scheme. In 1904 it was decided by the Army department to initiate an experiment near Kalpi under the superintendence of the Forest department. Eight hundred and seven acres of ravine land were taken up, ravines were dammed and babul sown. A recent inspection has shown that the early sowings have established themselves, the later sowings promise well, there is a vigorous crop of young plants from one to eight years old, and the whole area will in another year be fully stocked. The plantation should be ready for felling by 1920 at the latest, when about 10,000 trees should be yearly available. It is anticipated that the experiment may prove financially self-supporting, but in this connection it must be recognized that the Kalpi undertaking was a pure experiment and lacked the guidance of previous results, and also that its object was the production of babul bark, and not the afforestation of ravines, for which purpose there are other species besides the babul whose propagation presents less difficulty. The sowings had also to contend, in the frost of 1905 and the droughts of 1906 and 1907, with seasons abnormally unpropitious.

The experiment has in any case been valuable in indications, which will save future expense, and the Lieutenant-Governor is assured that it goes far towards proving that the afforestation of ravines is quite practicable and in all probability remunerative.

10. A most interesting experiment has also been undertaken at Thapal in the Saharanpur district by an enlightened landholder, Rai Manohar Lal Bahadur. His estate of 771 acres is situated in the Saharanpur district near the foot of the Siwalik hills, and only about a mile from the reserved forests. It contains 103 acres of cultivation and about an equal amount of waste land, the remaining area being covered by poor miscellaneous forest. The soil outside the cultivated area is exceedingly poor, and would have been of little value to the owner had he not adopted the wise plan of carefully preserving and fostering the existing growth and making plantations where no such growth existed. Prior to 1892 no attention was paid to the forest area. From 1892 to 1901 only very limited protection was extended to it, and no definite method of treatment

had been decided on. In 1901 advice was obtained from the Forest department, and the miscellaneous forest area has since then been protected from browsing animals and has been worked under the system of coppice with standards, and large blanks of waste land have been planted with bamboos, shisham, eucalyptus and other trees. Altogether between 1901 and 1907 an area of about 73 acres was successfully brought under shisham. In 1908, at the request of the owner, the Forest department drew up a working plan for the estate, and this is of particular interest as being the first attempt in these provinces to systematize the working of a private forest. The working plan estimated that after eight or ten years the average annual receipts would amount to Rs. 5,650 and expenditure to Rs. 3,250, or an average surplus of Rs. 2,400, and this forecast seems to be in a fair way to fulfilment. During the six years previous to the introduction of the working plan the annual expenditure (incurred chiefly on planting work) had exceeded the revenue. This shows that the proprietor fully realized from the first that, in order eventually to realize the maximum interest on his waste land, he must first create his forest capital. The resulting young forest is now in a flourishing condition and is under the supervision of a trained staff consisting of a deputy ranger and two guards. The owner will now have the satisfaction of reaping substantial returns from areas which would otherwise have remained unproductive waste.

11. The Forest department in the initial stages of its development was primarily a commercial department and concerned with the production of large timber; its interests were inevitably antagonistic to agriculture in that intense management demanded the exclusion of cattle-grazing. But since the time of Sir Dietrich Brandis it has been recognized with increasing clearness that forestry has a vocation no less important as the handmaid of agriculture, and that she is called to come down from the hills. Big timber need not, as Sir Dietrich Brandis urged in 1883, be the only or even the main object of a forester's existence. Among the peasants' greatest needs are firewood to replace manure, small timber for houses and wood for implements as well as grazing or fodder for his cattle. There is therefore a place for a branch of forestry in which these commodities, regarded by the commercial forester as accessories, become the main considerations of his craft.

The Tikri forest in Gonda affords an example of the successful administration of such an area worked almost entirely for the production of fuel, both as a revenue-earning undertaking and as a valuable factor in the economy of a district. This forest now constitutes the only extensive wooded tract in a large area of high

cultivation ; it came under mauagement in 1879-80. In the twelve years succeeding its reservation, the total expenditure on the forest amounted to Rs. 26,750 and profits to Rs. 26,900—a ratio of over 100 per cent. expenditure. In the ten years from 1891 to 1901 the gross income of the forest was Rs. 1,22,600, the gross expenditure Rs. 68,000, and profits Rs. 54,600, or about 80 per cent. on the expenditure. The average yearly profits were Rs. 4,360. Since then profits have risen substantially, reaching in the year 1902 the large figure of Rs. 17,260, while working expenses have averaged about Rs. 4,000. The produce of the forest is almost entirely fuel and grass, the former being bought in considerable quantities by the railway. In 1902, at the time of settlement, the Government received information that the ravages of wild animals and cattle harboured in the Tikri forest had effected a material detrioration in surrounding cultivation, and the local authorities were asked to consider the desirability of disforestation. The settlement officer urged that, while it was a fact that deterioration had occurred from this cause and from the effects of the forest on drinking water, the value of the forest as a grazing reserve and fuel producer was so great as to render its abandonment a step of doubtful wisdom. He pointed out that wood for fuel, implements and house-building was 25 per cent. cheaper in Gonda than in the trans-Gogra districts, and that this prie could not be maintained if wood had to be brought from submontane tracts ; he suggested that deterioration could be largely arrested by the organized destruction of wild animals, and urged that forests standing in a highly cultivated area required different treatment in this respect to forest surrounded by wild tracts. He admitted that some direct advantage to the revenue would result from the forest being brought under cultivation, estimating that in twenty-five years the revenue assessed would amount to Rs. 10,620. Systematic action was taken to reduce the wild cattle and other animals harboured, the deterioration in surrounding cultivation complained of seems to have disappeared, and the idea of disforestation has been abandoned. A further examination of the financial aspect of the matter produced a forecast from the divisional forest officer which would show that in twenty-five years the revenue accruing from the forest will amount to over Rs. 20,000, a sum about double that anticipated from assessment to land revenue.

An extension of agricultural forestry on these lines might go far to remove the distrust of the department which has prevailed among the cultivating population by the addition of a visible policy of giving to the inevitable policy of taking away.

12. Such a development has, the Lieutenant-Governor recognizes, been hitherto impracticable, owing to the inadequacy of the

existing staff, an increase in which had to be justified by pointing to an increase in revenue, and owing to their necessary concentration on the settling and management of the extensive reserved forests of the province. Sir John Hewett is, however, convinced that a stage has now been reached in the economic development of the province when systematic examination of the possibilities of afforestation is imperative. The fuel and fodder reserves at present in existence constitute an insignificant proportion of the provincial area. The whole area of reserved forest is at present about 4 per cent. of the total area ; the addition of the Kumaun " protected " forests will raise the proportion to 6 or 7 per cent. Of this reserve much is necessarily not available for fodder or fuel. It is, moreover, largely concentrated in certain areas, and extensive tracts are situated at such a distance from the forests that the latter cannot serve as fuel or fodder reserves of them. With the agricultural and industrial development of the province a rapidly expanding demand for forest produce, and in particular for fuel, small timber and grass, must be anticipated. For the future economic progress of the people the Lieutenant-Governor believes it essential that action should be undertaken to provide well-distributed areas for the production of these commodities. Such action will prove increasingly difficult to initiate as agriculture and industries expand. Systematic action is at the present juncture even more urgently demanded to prevent the progressive reduction of the restricted area remaining under forest—a process which without State interference must operate with increasing rapidity. The disappearance even of private forests threatens to jeopardize the existence of the reserved forests since it tends to throw upon the latter a burden in providing grazing which they cannot hope to support. Moreover, the increasing pressure of population and cultivation upon existing reserves bids fair at no distant date to react with destructive effect on the cattle-supply of the province and, through the cattle, directly on its general agricultural prosperity. It involves, moreover, a disastrous rise in the price of timber such as is at the present moment apprehended in Europe, an apprehension which has in England lent stimulus to a national afforestation movement. In view of the demonstrable contraction of fuel supplies in the plains of the province and with the experience of the Punjab before him, Sir John Hewett regards the need for definite action as imperative.

13. Afforestation is, however, a branch of forestry which differs widely from the management of existing forests, and it is a branch in which the officers of the Forest department have as yet had little experience. The Lieutenant-Governor therefore considers

it essential that, before a definite scheme of afforestation is embarked on, a systematic survey of the available area should be undertaken and that this survey should be combined with a series of experiments on various classes of waste land with a view to determining the best methods of dealing with different soils, the species best adapted to various conditions and the cheapest and most efficient methods of propagation. It will not always be necessary to contemplate acquisition. It may prove possible to arrange with owners or communities that they should allow Government to afforest their land in return for profits or a portion of profits.

The policy thus adumbrated may eventually necessitate the creation of an afforestation branch of the department, but the Lieutenant-Governor wishes it to be clearly understood that, even with such a development, the rôle of the department is not to manage the forests which local bodies or zamindars might establish, but to advise the owners in the methods of management, and to give them any assistance, which they might ask. For the purposes of the present survey His Honour considers that the deputation of a single imperial officer with a small staff will meet the situation. The Lieutenant-Governor has decided to depute Mr. E. A. Courthope, Deputy Conservator, to the work. Mr. Courthope has (under the advice of the Director of Indian Forest Studies and of Sir William Schlich) undertaken a two-months' tour in Europe with a view to studying examples of afforestation practice. Sir John Hewett regards his appointment as the first step in an undertaking which may prove of incalculable advantage to the province.

APPENDIX IV.

Report on the ravine land of the Etawah district, with certain proposals for the improvement of the pasture, by MR. E. A. COURTHOPE, Deputy Conservator of Forests, Afforestation division, dated the 30th April, 1913, with letter of the Collector of Etawah on the subject.

IN resolution no. 348, dated the 26th August, 1912, it is stated that the attention of His Honour the Lieutenant-Governor has been directed to the importance of the future development of a defined policy in the matter of the preservation of the existing forests of the province, and of the re-afforestation of denuded areas, and of the establishment of fuel and fodder reserves throughout the province. The resolution admits the incontrovertibility of Dr. Voelcker's arguments in favour of formation of fuel and fodder reserves, and the truth of his statements that this is "the one practical measure which calls for the most urgent attention and from which the greatest benefits may be expected to follow"; but goes on to point out that there are certain inherent difficulties which render it in this province a more difficult matter than in Madras where the State owns all waste land, to summon forestry to the aid of agriculture. On the other hand, it is stated that Sir John Hewett was not convinced that these difficulties were in any way insuperable, and the resolution concludes by suggesting the possibility of establishing an agricultural branch of forestry in the province.

As a result of this resolution I was deputed on my return from leave early in December, 1912, to make a preliminary survey of the waste land of the province, and in due course I shall submit a report on my observations and conclusions. During the progress of my tour I received instructions from the Conservator of Forests, Eastern circle, to inspect and report on a block of 3,000 acres of ravine land, the acquisition of which was contemplated in the Etawah district, a district which I should in any case have visited later on in the season.

In consultation with the Collector of the district, Mr. H. R. Nevill, I decided that it would be useless and most unwise to acquire this block, as it was too small to demonstrate practically and economically the advantages conferred on a district by the proper management of such waste areas, while, in the Collector's opinion, the acquisition of selected blocks from certain villages would inevitably cause jealousy and bad feeling among the landholders. In this opinion the Conservator fully concurred.

On the other hand, I was so impressed with the unique opportunity presented by the Etawah district, of carrying out the policy outlined in the resolution, that I have obtained permission from the Conservator of Forests, Eastern circle, to submit a special report on the advisability of acquiring practically all the ravine land of the Etawah district in place of the report originally called for by him, and in anticipation of my annual report I may add that the ravines of the Etawah district are mentioned in a note written by Mr. W. H. Moreland, C.S.J., C.I.E., late Director of Agriculture, as being suitable ground for afforestation purposes.

In paragraph 12 of the resolution it is stated that the "fuel and fodder reserves at present in existence constitute an insignificant proportion of the provincial area . . . of this reserve much is necessarily not available for fodder or fuel purposes. It is moreover, largely concentrated in certain areas, and extensive tracts are situated at such a distance from the forests that the latter cannot serve as fuel or fodder reserves for them. With the agricultural and industrial development of the province a rapidly expanding demand for forest produce, and in particular for fuel, small timber and grass must be anticipated . . . Moreover, the increasing pressure of population and cultivation bids fair at no distant date to react with destructive effect on the cattle supply of the province and through the cattle, directly on its general agricultural prosperity . . . Sir John Hewett regards the needs for definite action as imperative." I have quoted the above passages from the resolution, because they seem to me to apply with particular force to the Etawah district.

A reference to the gazetteer shows that the total area of the district is 1,082,443 acres. Of this area 368,674 acres are shown as uncultivated waste land, 171,943 acres being *usar* and 130,147 acres ravine jungle.

The figures given in the gazetteer are taken from the survey of 1872. Since this date there has been a considerable reclamation of *usar*, and to a less extent of the ravine belt along the edge of the cultivation, but a comparison of the old and the new maps shows that such gain is more than counterbalanced by the loss of cultivation caused by the inland extension of the ravines, which in some localities has been alarmingly rapid.

The northern half of the district consists either of *usar* interspersed with patches of cultivation or of cultivated land with very numerous patches of *usar*.

The southern half of the district is mostly ravine land with strips of unbroken cultivated land. This part of the district is intersected by the Sengar, Jumna, and Chambal rivers. The Sengar

river is a small stream of little importance. On either side of it there is a narrow strip of ravine land, the total area of which amounts to about 10,000 acres.

Along each bank of the Jumna and Chambal rivers there is a very narrow bit of low alluvium, in which the cultivation is of a very high order. The upland, scoured by innumerable ravines, rises sharply from these belts to a height which ranges from 15 to 150 feet above the river. These ravines extend inland for distance which varies from a few furlongs to a few miles, leaving an ever-narrowing strip of unbroken and cultivated land between the Chambal and Jumna and again between the Jumna and Sengar rivers.

As will be seen from the maps attached, the ravines of the Jumna and Chambal rivers form a practically compact mass, the extreme length of which is seventy miles and the width of which is about thirteen miles in the centre. The actual area of the ravines in this tract is about 120,000 acres.

The population of this tract consists for the most part of Thakurs, a well-bred but impoverished race, heavily burdened with debt, who depend for their livelihood on cattle-breeding and the *ghi* industry, and to some extent on foreign service. In their villages even the supply of drinking water is inadequate, while irrigation for their fields is impossible. In years of drought they derive nothing from their cultivation, and in places the very absence of water for drinking forces them to migrate. Depending as they do on their cattle the question of fodder is at all times of vital importance to these people. It is impossible to state definitely how many cattle are now being grazed on the 120,000 acres, but the Collector estimates the figures at not less than 200,000. Inspection of many parts of the ravine tract compelled me to wonder where grass for such a number of animals could be found on the ravines in their present condition. Close examination of the apparently bare slopes and ravine banks reveals the fact that there are plenty of grass roots in the ground and that the ravines are therefore capable of producing, under proper management, an excellent crop of fodder; but this crop is so regularly grazed down from year's end to year's end by an excessive number of cattle that it gets no chance of developing itself or increasing in quantity. The Collector informs me that the cattle are deteriorating, and that the want of good fodder renders it impossible for the Thakurs to breed bullocks fit for agricultural purposes or to expand the *ghi* industry. Further, he states that a cycle of bad years results in the disappearance of a great number of the animals. This is not to be wondered at, in that not only is there barely sufficient

grazing to keep the animals alive now, but there is no reserve of cut grass fodder whatsoever.

The whole of the ravine country is sparsely covered with a low scrub, consisting mainly of karil. The tree-growth is very uneven. In the parts most remote from villages there is often a fair covering of miscellaneous trees, in a few places the growth was noticed to be remarkably good but elsewhere nothing is to be seen except scattered *babul*, *cheonkar*, *rionja*, and *nim* trees, and even these are generally lopped. Along the bottoms of the ravines good *sissoo* is occasionally found. Reproduction is almost non-existent, trees getting but little opportunity to produce seed owing to the ruthless lopping which is carried on by herdsmen, while such seedlings as spring up here and there are regularly year by year trampled down and browsed over by buffaloes and goats. As has already been mentioned, there is plenty of grass on the ground if it were allowed to grow. The quantity and quality vary from place to place but it is most noticeable that there is more and better grass where there is a light covering of trees than where the ravines are wholly bare.

The ravines are the property of zamindars. No grazing fees are levied from the tenants directly, but permission to graze is utilized as lever for raising rents. Occasionally fees are levied from owners of cattle sending their animals from "foreign" villages, as, for instance, in the ravine south of Auraiya, where inhabited sites are few and the demand for grazing rights by resident tenants is not so heavy.

No attempt is made by the zamindars or by the graziers themselves to control or regulate the grazing or to preserve the fodder; there is no restriction within the village boundaries on the number of cattle which may graze in any area.

No attempt is made by most zamindars to promote tree-growth; villagers may lop trees as they please, and may fell them after obtaining the formal consent of zamindars, which is rarely withheld.

There is little, if any, export of timber, firewood or charcoal, even into the city of Etawah, which has in consequence to obtain its supply at almost prohibitive rates from a great distance. At present there is no great demand for firewood outside the city and larger towns, as the people prefer using their cowdung as fuel to picking up the very scarce fallen wood or going to considerable distances to cut dry trees.

The above depressing state of affairs may be briefly summarized as follows:—

The Etawah district contains a relatively greater proportion of waste land than any other in the plains of this province and yet

possesses no fuel or fodder reserve. The district has a smaller cultivated area than most plains districts, and development is checked by the encroachment of the ravines.

A great part of the population depends for its livelihood on its cattle and has not, under present conditions, sufficient fodder to enable it to produce good cattle, much less to expand the *ghi* industry, of which the district is a centre. Yet the district contains at least 120,000 acres of good ravine land capable of producing a large crop of excellent cut fodder and of affording excellent pasture to the present number of cattle or even to a large number of a superior breed. In spite of its vast area of uncultivated land the district does not produce a sufficient quantity of fuel or timber for the needs of the inhabitants. The unirrigated part of the district suffers from a serious lack of water and especially of tanks for watering cattle.

I have said that the statements made in paragraph 12 of the resolution of the Local Government appear to be peculiarly applicable to the Etawah district. The same resolution has suggested an agricultural branch of the Forest department as a remedy for the present unsatisfactory state of affairs. It will be well therefore to discuss generally the ways in which such a branch of forestry may be useful.

Obviously by sowing and planting trees it will be possible, in the course of time, to supply the district with timber and fuel. Dr. Voeloker considers that the supply of a sufficient quantity of fuel is the most important agricultural problem to be solved. He shows that by this means the cowdung, now used in enormous quantities as fuel, will be set free for its proper use as manure; that the treatment of the fields, with manure will result in more cattle fodder, which will result in an increase of cattle and consequently in an increase of manure. But there are other ways, less obvious perhaps, in which afforestation of bare grazing land is useful. I have not had an opportunity of discussing this matter with the Director of Agriculture, but a conversation with the Deputy Director confirmed my impressions as to the importance of shade for the cattle. He told me that he thought that the apathy displayed by the people of Bundelkhand towards the improvement of their stock was in a large measure due to the fact that they had nowhere to take their cattle during the scorching months of April, May, and June. He believes that if there were forests in which the cattle could find fodder and shade, their condition would be much improved. The same argument applies to the bare ravines of the Etawah district.

Moreover, there can be no doubt at all that the existence of a light tree-growth improves the growth and quality of the grass.

Again, the afforestation of the ravines would undoubtedly check erosion and retard or prevent altogether the inland extension of the ravines. Further, the usual methods adopted for the afforestation of such places, namely, the erection of numerous small dams, will result in the retention of water and the formation of water tanks which are so urgently required for the cattle.

But although the afforestation of the ravines would be the most obvious duty of an agricultural branch of the Forest department, this would be by no means its only or even its most important duty, at any rate at the beginning. The first duty of an agricultural forest officer in Etawah would be to improve the growth of the grass itself, with a view to the supply of out-fodder and the improvement of the pasture. How this can be done will be shown in a later paragraph. The improvement of the fodder must result in an improved breed of cattle. The Deputy Director has described the supply of good fodder as being the root of the whole question of cattle-breeding. At present weak, under-fed cattle breed with their like and produce even weaker calves, which are starved and neglected and grow into undersized and useless animals.

As I have summarized the present evil state of affairs in the Etawah district, I will also briefly recapitulate the benefits which an agricultural branch of forestry can confer on the population :—

- (1) A plentiful supply of wood fuel releasing the cowdung for the fields.
- (2) As a result more cattle fodder from the fields.
- (3) Consequently better cattle, more *ghi*, better cultivation, greater profits from cattle-breeding, more general prosperity.
- (4) Improved pasture and a plentiful supply of out-fodder, bringing the same general increase of prosperity through the cattle.
- (5) Improved conditions of grazing resulting from the supply of shade: this will result in less mortality among the cattle.
- (6) Increased water-supply from the formation of numerous small tanks.
- (7) Cheap supply of building timber.
- (8) The employment of a large number of villagers as forest guards, patrols, etc., and a general increase in the demand for casual labour.

It needs no argument to prove that such achievements must conduce greatly to the increase in the general prosperity of the district.

It now only remains to make definite recommendations for the consideration of the Local Government. The Collector has assured me that there is not the slightest hope of securing any improvement in the existing state of affairs by private agency. It may be mentioned here that the management by private agency of the Fisher forest, which is said to have been in a most flourishing condition, has resulted disastrously. The zamindars of the district will not incur any expenditure or forego any present advantages for the sake of future improvement. The undertaking is beyond the scope of the District Board or the Court of Wards, but is essentially one to be handled by the Forest department. It is imperative to make the zamindars and cultivators understand that the scheme is intimately connected with the improvement of agriculture and amelioration of a highly precarious tract, and every effort should be made to secure their co-operation in the execution of the project ; but I am convinced that success can only be achieved by the acquisition by Government of the whole of the ravine tract of the district with, perhaps, the exception of the narrow strip of ravines along the Sengar river, which are situated at some distance from the main mass and are of somewhat different character. In my opinion it would be unwise to take up anything less than the whole tract. In a matter of this magnitude, which embodies a general scheme of policy, it is most desirable that there should be uniformity by treatment. Moreover, it is only by treating the whole tract at one time that it will be possible to demonstrate thoroughly and at the same time economically the benefits that will result from the scheme.

The initial cost of acquisition would not be great. The intrinsic value of ravine land cannot be more than Re. 1 per acre plus the value of the very sparse tree-growth. At an outside figure the value of the best ravine land would not exceed Rs. 5 per acre, and since by far the greater portion of the tract is absolutely devoid of tree-growth it will be perfectly safe to assume that the cost will not exceed Rs. 2,50,000, while it is probable that after demarcation of the area it will prove to be even less.

I would strongly urge then the advisability of the acquisition by Government of the whole of this ravine tract and the formation of a forest division, and, though, of course, it is not yet possible to work out detailed plan of management, I think it may be as well to roughly outline a scheme in case the Local Government may agree to my recommendation.

It has already been suggested that the first duty of the forest officer in charge of the proposed division will be to improve the growth of grass and in any plan for the working of the division,

the question of grazing must be looked upon as of paramount importance. I would recommend therefore that at the very start the tract should be divided up into grazing blocks with a view to giving each village or group of villages equal grazing facilities, and that these blocks should be treated as units of management.

The one great objection to forest management in the eyes of the villagers is the imposition of restriction on grazing. It must be obvious, however, that without some restriction and control no improvement can be effected. It must be our task to make such restriction as light as is consistent with success. The whole area has been grazed over from year's end to year's end for a very long period, with the result that the grass has lost its vitality and cannot thicken. The result of closure to grazing is most evident in the ravines of the Kalpi reserve in the Jalaun district. This area is surrounded by ravines quite as bare as those of Etawah, but inside the fence there is a thick covering of grass, which has been sold at 8 annas per acre. After it is cut, there is grazing for a considerable herd of cattle, although, as a matter of fact, up to the present time no grazing has been permitted. The same result may be seen anywhere where grazing is regulated.

I would suggest therefore that one-fourth of each grazing block should be closed in rotation to grazing for a period of three or more years, in order to allow the grass to recover its vitality and to thicken. The duration of this period must depend on results, but I believe that three years will be sufficient. In that case, at the end of twelve years, there should be a material improvement over the whole area. It must, of course, be admitted that for this period the cattle will be confined to three-fourths of the present area. Provided the first three years are good years (in a bad year, of course, the closure, must be abandoned) I do not think it will entail any serious hardship, and such as there may be will be mitigated by the supply of cut-fodder which will be available. After the first three years I contend that, although the area open to grazing will still be less than at present, the improved pasture on the quarter just thrown open will fully compensate for the difference. At the end of nine years the grazing on the improved three-fourths of the area should afford far more pasture than the whole of the present area. At first, I contemplated the charging of small grazing dues from the start with a view to bringing in some slight return from the outlay incurred by the Government. The Collector, however, was of opinion that the villagers would resent having to pay dues for the same poor grazing that they now get free. He suggested that grazing should be allowed free on unimproved areas, and he believes that there will

be keen competition among the cattle-owners to graze their cattle, on payment of dues in the improved areas as they are thrown open. I think this is a very reasonable proposal. For the first three years all grazing would be free. In the second period half of the area would be open for free grazing and one-fourth would be available for the restricted number of cattle belonging to owners ready to pay the dues. After six years one-fourth of the area will be open to free grazing, and only half will be open to grazing on the payment of dues. After nine years there will be no free grazing at all, but by that time the graziers will have realized the advantages conferred upon them.

In view of the urgent need of cut-fodder in the district as a reserve against bad years I would also recommend the additional closure of a second quarter of each grazing block for four months from July to October, during which season the remaining half of the area should afford ample grazing for the cattle of each village. The grass would be cut in October and the area would again be open to grazing in November. Not only will this measure ensure a large supply of cut-fodder, but it will also improve the grass for grazing purposes. The importance of this can hardly be exaggerated. In the last fodder famine thousands of tons of grass were cut in March and April; much of this proved useless except as litter, because it was cut at the wrong time of year. Even in good years there is always a demand for cut-fodder in the hot season, so that it is not necessary to wait until famine has established itself to lay in a stock of cut-fodder.

So far I have discussed only the measures necessary for the improvement of the grass on the ravines, which, I repeat, is the most important objective. The restrictions which I have proposed are not, I think, such as to cause much discontent, while I am convinced that they will result in very material improvement to the pasture. It must not be forgotten, however, that we have other objectives, such as the supply of fuel and timber for the district. Afforestation on a large scale would necessitate the closure of a larger area than is advisable at present, in view of the poor character of the grazing. If the grass were as thick and abundant now, as it would be in due course if properly preserved, I should have no hesitation in recommending the establishment of large regular plantations; for I have absolutely no doubt at all as to the capacity of the ravines for growing forests or as to the feasibility of their establishment. But things being as they are, I would not recommend afforestation on a large scale for the first twelve years. On the other hand, I think a beginning should be made.

The mere protection of tree-growth in the closed quarter of each

grazing block is likely to effect an enormous improvement, by allowing young seedlings at present browsed down by goats year after year to assert themselves, and by allowing lopped trees to resume their development. This natural improvement, moreover, will indicate the most favourable lines of special development in the future. But rather more than this is necessary. I would recommend that in each grazing unit general improvements should be undertaken in the closed quarter. Dams should be thrown up and seed sown ; seed will be sown broadcast in favourable places ; soil will be wounded round trees, and so on. Much of the work, no doubt, will be destroyed when the area is thrown open, but some will escape, and this alone will be worth the small expense incurred. At the same time, however, some regular plantation work would be necessary. This would be mostly on the experimental lines, so as to ascertain the species most suitable for the locality, and the best and the most economical methods of establishing plantations of these species. I would recommend the closure of quite small areas for this purpose. These would, of course, be kept closed to grazing until such time as the trees are immune from damage by cattle. This period would vary with different species, but it would be safest to assume, to begin with, that these small areas would remain closed for the first twelve years. As, however, I do not anticipate that the whole area so closed could amount to more than 8,000 acres in this period, the fact of the closure need not be considered as inflicting any hardship on the graziers.

It is recognized that the closure of a proportion of the area to grazing may lead to the increase of destructive animals, such as pigs. It would be necessary to take steps from the very start to keep these down or even to exterminate them from the forest.

I do not propose to attempt in this report any financial forecast. The undertaking should not at the outset have as its objective the realization of a substantial revenue. The grazing alone would yield a satisfactory return is more than probable ; but the establishment of the first agricultural forest division would necessarily be in some measure experimental. I would only say that I am convinced that not only will Government be conferring an immense favour upon the population of the district, but that eventually it will not be a loser by its beneficial policy.

No. 1976, dated Etawah, the 7th May, 1913.

From—H. R. NEVILL, Esq., Collector of Etawah,

To—E. A. COURTHOPE, Esq., Deputy Conservator of Forests,
Afforestation division, Eastern circle, United Provinces.

SIR,—I have the honour to acknowledge the receipt of your

no. 39, dated the 30th April, 1913, enclosing the draft of your report to the Conservator of Forests on the subject of the possible afforestation of the ravines in this district.

The question is mainly one of general agricultural and financial policy on which I am not competent to offer any opinion. Were the Government to decide on the acquisition of all waste land in the ravine tract and the subsequent exploitation of that tract as a grazing ground, it is difficult to avoid the conclusion that the venture would be not only beneficial to the people, but also profitable to the State. The scheme involves a wholesale application of the Land Acquisition Act and a consequently large initial outlay. While I believe that the measure would be not unpopular even at the outset and that the interest on the capital expended would be highly satisfactory with the scheme in full working order, it would be idle and presumptuous for me to make any specific recommendation as to the direction of the forest policy to be followed by the Local Government.

As to the various points dealt with in the report, I would offer the following remarks :—

1. The actual area of ravine land along the course of the Jumna, Chambal, and Kuari rivers in this district cannot be stated with any approximation to accuracy without a detailed investigation of the records in each village. In the event of acquisition it would be imperative to demarcate not only the unculturable ravine area, but also the unreserved area immediately adjoining the sites of such villages as are situated in the ravines. In such cases it would be obviously impossible to preserve the grazing up to the walls of the houses, and it would be necessary to leave untouched a definite curtilage of considerable area, demarcated, if possible, by natural features. Even with deductions on the most generous scale, the area left could not be less than 100,000 acres, and would in all probability be more extensive.

2. I have not the slightest doubt that the whole of this area would, under a system of protection, yield a good growth of grass. The quality of the grazing would doubtless vary greatly. In the beginning the lower levels would improve far more rapidly than the dry and overdrained summits of the ravines where trees and scrub are generally non-existent and the grass has no shade at any hour of the day. That trees of useful species will grow everywhere needs no demonstration, and in my opinion it may be taken as an axiom that once tree-growth has been established a heavy crop of grass will be obtained. In the more remote portions of the tract the vegetation in the shape of both grass and trees is most remarkable, and I see no reason why the whole of the area should not

become at least the equal of the best portions of the present time. It should be borne in mind, however, that development would be uneven, and this unevenness would affect whole grazing blocks of the type suggested. The proposed scheme of conservation consequently would require individual treatment in the matter of temporary closure.

3. It would be necessary to insist firmly on the principle of free grazing in unimproved areas. I willingly concede that the graziers would pay without demur light fees for the privilege of pasturing their cattle in the improved sections; but even though the land should be recognized as having been fairly purchased by the State, the villagers would feel aggrieved at having to pay for the same quality of grazing as they had hitherto obtained free from time immemorial. That they would gladly pay the light fees suggested for good grazing appears certain. In the reserve known as the Fisher forest, where the grazing is of the poorest description, herdsmen consider it worth while to pay at the enormous rates of Rs. 2 per cow and Rs. 4 per buffalo. So far as my information goes, these rates are far higher than any charged by the Forest department in any of the richest ranges of forest, worked admittedly as a commercial undertaking. It might be urged that if graziers will pay these rates in a reserve which affords the poorest sort of grazing to an unduly large number of cattle, they would pay as much for better and more abundant, because properly controlled, grazing. But, as your report so clearly points out, the primary object of reservation and afforestation is the immediate benefit of agriculture, and as consequently there is no object in making these forests more than self-supporting, it would be unnecessary to demand grazing fees higher than an average of six annas per head. This would yield, at the rate of one animal per acre, over Rs. 35,000 per annum on account of grazing alone, irrespective of the large income which in time would accrue from dried fodder, timber, fuel, and charcoal.

4. Personally I would lay more stress than has been laid in the report on the resultant improvement of the stamp of cattle. This is a matter of the highest importance. The supply of cattle is short, and will probably become shorter before many years pass. It is obvious that a district like Etawah, with its immense areas of potentially fine grazing, ought not to be compelled to go far afield and pay an unduly high price for its agricultural stock. Better grazing must result in improved stock, that is to say, better bullocks for the plough and better cows for the *ghi* trade. I have no great belief in the system of excluding indifferent animals from controlled grazing grounds. To attempt to do so is to put a

premium on petty fraud, and is, moreover, in my opinion, unnecessary, inasmuch as the graziers will gradually find it unprofitable to pay for the upkeep of inferior beasts when they can support better animals at the same cost. I hold very strongly that no improvement is to be expected except as the result of direct encouragement by the State. I do not for a moment believe that private land-owners can or will improve their grazing grounds. That they should do so goes without saying, but to expect that they will ever have the enterprise and far-sightedness to do more than tinker with such a project is to my mind the vain hope of an unwarranted optimism. If the grazing be not improved, it is idle to hope for an improvement of stock; and similarly I hold that, in the interests of agriculture, the State alone can improve the general quality of the stock after the grazing grounds have been brought under systematic control. In conjunction with, or perhaps subsequent to, the conservation of the grazing areas, it would be a most beneficial measure to start large cattle farms in which not only the bulls, but also the cows should be owned by the State. With scientific management and supervision it would be possible to employ sound selection, and the result would be of incalculable value. It is unnecessary to dilate on the prospects of such an enterprise, but I hold that, if it be thought advisable to regulate grazing, some scheme of cattle farming should, without question be embodied in the general project.

5. Incidental to this is the thorny question of an improved milk-supply, a problem of prime importance, in urban areas. The appalling rate of infant mortality even in a healthy city like Etawah is, wrongly, or rightly, attributed in large measure to the extreme difficulty of obtaining pure cow's milk. That this should be the case in the centre of a tract which is pre-eminently fitted for grazing is a fact as remarkable as it is apparent. The maintenance of a large and hygienic dairy does not fall within the scope of legitimate municipal enterprise, but the problem would be solved to a large extent by the establishment of a cattle farm of sufficient size. I believe that dépôts for the sale of milk would prove a profitable venture, but only in connection with a cattle farm established primarily for the production of young stock. A mere dairy might fail, to judge by the results of private enterprise, but there would be no fear of such failure in a farm where the milk would be regarded almost as a by-product.

6. I am entirely in agreement with your views on the subject of dry fodder and fuel and charcoal. All of these ought to be abundant in this district, but all are scarce and dear. I do not propose to discuss the details of suggested management, as these lie

wholly beyond my province. Should the scheme be accepted by the authorities, I believe that its execution would be wholly beneficial. I should like to add that I am opposed to any sporadic experiments. As I have already stated, I consider that no experiments are required and that demonstration should be the widest possible scale to be effective. To acquire small areas would result in much heart-burning. Were all owners treated alike, I believe that the measure would rapidly attain general popularity. The area is undeveloped and unexploited. The owners are in most cases too poor and too ignorant to be capable of improving their grazing grounds. The acquisition of their unculturable lands by the State would not only lead rapidly to a great amelioration of their economic condition but at the very outset would yield them a fund of ready cash which would enable them in many cases to redeem the numerous mortgages and would preserve their ancestral cultivation to a most valuable class of hardy agriculturists.

7. The two copies of the draft and the maps are returned herewith.

APPENDIX V.

Report of the proceedings of a conference held at Etawah on the subject of the desirability of the afforestation of the ravine lands in the Etawah district and their development as a fodder and fuel reserve.

1. The question of the possible utilization of the large area of ravine land in the Etawah district has been considered on several occasions. Apart from the very promising experiment in the area known as the Fisher forest in the immediate vicinity of the town, the attention of the Government was drawn by Mr. W. H. Moreland, C.I.E., when Director of Land Records and Agriculture, to the great potential value of the extensive ravine tract which extends throughout the southern portion of the district more especially with the object of preserving and improving this tract as a breeding-ground for agricultural stock. Special reference to Etawah was made in his report on the improvement of Indian Agriculture by Dr. Voelcker who in 1890 laid down that the prime necessity was the creation of extensive fuel and fodder reserves wherever such reserves might be possible. The subject was revived in the resolution no. 348 of the Government, United Provinces (Forest department), dated the 20th August, 1912, wherein stress was laid on the urgent necessity of subjecting to careful examination such tracts as offered promise of improvement under a regular system of afforestation. To this end Mr. E. A. Courthope, Deputy Conservator of Forests, was deputed to conduct a survey of the most promising areas. This officer, in company with the Collector, visited a considerable portion of the ravine area in the Etawah district during the cold weather of 1912-13. His opinion as to the highly-promising nature of the country was embodied in a report to the Conservator of Forests, Eastern circle, wherein he advocated the acquisition by Government of the entire ravine area along the course of the Jumna and to the south of that river to the extent for some 100,000 acres.

2: In view of this report and the recommendations made by the Conservator, Eastern circle, the Local Government directed that the scheme should be considered carefully by a committee selected for the purpose, with instructions to examine the various points raised, and to submit to Government such recommendations as might be approved after consultation. Facilities were afforded to the members of the committee for visiting the experimental plantation at Kalpi, and several members availed themselves of the

opportunity. While at Etawah visits were paid to Udi and to Lakhna, so that those members who were unacquainted with the tract might be enabled to examine representative blocks of ravine country presenting markedly different characteristics.

3. The following formed the Committee :—

The Hon'ble Mr. D. C. Baillie, C.S.I., I.C.S., Senior Member, Board of Revenue.

The Hon'ble Mr. F. W. Brownrigg, Commissioner, Allahabad division.

Mr. P. H. Clutterbuck, Conservator of Forests, Eastern circle.

„ H. K. Gracey, I.C.S., Collector of Farrukhabad.

„ E. A. Phelps, I.C.S., Collector of Jalaun.

„ H. R. Nevill, I.C.S., Collector of Etawah.

„ E. S. Liddiard, I.C.S., Settlement Officer of Etawah.

„ W. C. Cooper, Executive Engineer, Etawah division, Lower Ganges Canal.

„ C. W. Wilson, Superintendent, Civil Veterinary department.

„ B. C. Burt, Deputy Director of Agriculture.

„ E. A. Courthope, Deputy Conservator of Forests.

Captain G. W. Mellor, I.A., Assistant Director of Grass Farms, VII division.

The Hon'ble Raja Kushal Pal Singh of Kotla.

Raja Partab Singh of Malhajini.

Rao Raghubar Singh Bahadur of Bidhupura.

Kunwar Kanmohau Singh of Bangra, district Jalaun.

4. The Committee sat at Etawah on the 21st and 22nd of July, 1913, the Hon'ble Mr. Baillie being Chairman and Mr. Nevill, Secretary. All the members were present throughout the proceedings.

5. The first question for discussion was the need for action, that is to say, whether in the opinion of the Committee the existing system of management in the matter of grazing and the provision of fuel stood in need of amendment. On this point the Committee were unanimous. It has been clearly shown that grazing and felling of wood for fuel are conducted on no system whatever, with the result that the ravines in ordinary years yield the absolute minimum and in times of famine the produce is practically nothing. It was acknowledged that in years of drought the population and the number of cattle decrease, markedly and immediately, to the extent of at least 30 per cent., while the remainder of the cattle find subsistence for the time being by moving into other areas. Not only is the standing crop of grass wholly inadequate to the requirements of the people in times of stress, but the

absence of any reserve of fodder in the shape of cut and stacked grass renders it impossible for the people of this precarious tract to maintain the cattle on which they so largely depend.

6. There is evidence that, though cultivation has on the whole remained steady in the ravine tract from settlement to settlement, there has been a material and important extension of erosion at the top of the ravines. The extent to which arable land has suffered varies widely in different localities, but there is ample proof of very serious loss in the changed position of the old Mughal road, traces of the former alignment being visible in the middle of the Auraiya ravines, and elsewhere in the altered condition of the cultivated area noticeable on a comparison of the maps of the past and present settlement. Loss has been balanced by possibly a small increase in cultivation on the river banks below the ravines and by an extension of tillage, due to pressure of population, in the less favourable parts of the uplands which border on the ravines. It was recognised that the land lost was generally of the best quality obtainable in the tract, whereas the land newly reclaimed was on the margin of cultivation and more than ordinarily precarious and unproductive.

7. An examination of the figures available show for the tract as a whole no very material changes in the population. The returns of 1872 were rejected by the Committee as being probably unreliable; but a comparison of the statistics obtained at the census of 1891 and at the two following enumerations reveal a gain in certain parts, such as Patti Kamet, but a noteworthy decrease in the areas beyond the Chambal. The cattle census shows a general decrease in the number of animals, but possibly this is due to temporary causes. The latest figures are those of 1909, and the enumeration was made after a succession of dry years. The Committee consider that the returns of 1904 showed a normal strength of cattle, as there is no reason to believe that the ravine tract ever yielded more pasture or was materially more prosperous than at the present time.

8. The returns exhibit a marked increase in the exports of *ghi* from the various railway stations of the district. It is not clear, however, to what extent this increase has been derived from the tract now in question, inasmuch as the collecting trade has undergone an extensive development and the area served by Auraiya and other distributing centres is indeterminate. Large quantities of *ghi* are imported from Gwalior and Jalaun to stations in the Etawah district; but there is no reason to believe that the produce of *ghi* in the Etawah ravine country has diminished. On the contrary, it has probably increased owing to the rise in the number of buffaloes

which have been substituted for cows in consequence of the higher price of *ghi*. The buffaloes, however, depend to a very small extent on the grazing obtainable in the ravines and are almost entirely stall-fed.

9. The members of the committee expressed their agreement with the resolutions nos. 3 7, 10 and 11 of the Agricultural Conference held at Lucknow on 9th/11th August, 1909.

10. The resolution arrived at was that it is most desirable that any measures considered practicable be undertaken to increase the productiveness of the ravine tract for grazing purposes and the production of fuel.

11. The committee further resolved that it is impossible to rely on private enterprise to effect improvement, that the landholders are not in a position to make it possible for them to carry out any measures of importance, and that it is obviously necessary that any measures to be adopted should be undertaken, at any rate by way of demonstration, through the agency of the Forest department.

12. The scheme outlined by the Forest officers was explained in detail to the committee, figures being given for Sandaus, one of the areas now in question, to show the working of the proposals throughout the suggested cycle of twelve years. It was recognised that no hard and fast rule could be adopted for the entire tract, as development could not take place evenly throughout an area exhibiting marked variations of soil and physical conditions, and that consequently any scheme of rotation must be sufficiently elastic to admit of modifications in particular areas depending on the extent of land available for development and the incidence of the locality.

13. The Committee consider that treatment on the lines indicated is likely to effect a material improvement in the productiveness of the ravines. The experience afforded by the treatment of ravine land at Agra and Kalpi and by the closing of certain tractson the Rampura jagir warrants the belief that it is possible to secure a good growth of fodder grass in many places which at present are wholly bare. It was resolved that the block system with losure of fractional portions in rotation is the only system by which success can be expected ; and while it is noted that difficulties are likely to arise in connection with the arrangement of blocks so as to provide accessible pasturage for the cattle of every village at all periods of the rotation, it is held by the Committee that these difficulties are not in any way insuperable.

14. The Committee accept the general principle that one-fourth of each block should be closed to grazing at one time, but are

of the opinion that while in certain localities the number of cattle might render it necessary either to reduce the proportion closed or to lengthen the period of closure, there are parts of the tract in which a larger fraction might immediately be closed so as to secure more rapid improvement without inflicting any injury on the inhabitants.

15. An additional measure recommended by the Committee is that, in order to check erosion now in progress and to prevent any future extension of ravines in threatened localities, an area of width varying, according to the character of the soil, the slope of the ravines, and the catchment area concerned be excluded from cultivation and planted with trees.

16. The Committee are of the opinion that the demand for grazing all cattle now on the ground can be met throughout the initial period of management and that thereafter the area can safely bear an enormously increased incidence. Apart from the standing crop of grass available, there would be supplementary provision of the greatest possible value in the shape of cut grass. This would be available in large quantities at an early stage of the management and would prove of special use in the case of buffaloes and plough cattle which are in most cases stall-fed.

17. It is recognised that provision for grazing goats is absolutely necessary, as these animals constitute no small a proportion of the wealth of the tract. It is agreed that while the exclusion of goats for six years from the areas first closed would be advisable in order to secure the establishment of young tree-growth, it is essential to provide against any undue restriction of grazing. It might be necessary to avoid this by lengthening the period of rotation, but at the same time special provision for goats might possibly be afforded by sowing quick-growing fodder shrubs in those localities where grazing for these animals is in greatest demand.

18. The Committee had an opportunity of enquiring into local opinion on the subject of management. A number of small landholders from Patti Kamet and selected thakurs from other parts of the tract were present before the Committee, and it cannot be denied that the former, so far as they represented local opinion were almost entirely hostile to any action whatsoever being taken by Government as regards regulation of the use of the ravines. Of the rest Thakur Basant Singh, manager of the important Bhareh estate, alone expressed an opinion, and he agreed to any measures of improvement that might be approved by the Government. The Committee consider that the opposition should not be ignored, but that it should be rather regarded as a reason for working the proposals in a considerate and conciliatory manner than as a

ground for allowing this unreasoning antagonism to block the scheme in its entirety. As already remarked, the Committee hold that no system of management by the proprietors would be in any way practicable. They have neither the necessary unity in *pattidari* villages nor the requisite control over their tenants in *zamindari* estates to secure the desired results. The changes in management could never therefore be introduced save by the agency of Government.

19. The Committee recommend that operations be started in the *zamindari* areas of the tract under consideration, together with such blocks in *pattidari* villages as are necessary to afford a reasonable degree of compactness. It is held essential that the area taken under control should be large enough to secure economy of management and should not be less than 30,000 acres in extent. Such a tract could be obtained in the Chakarnagar, Sahson, and Bhareh *talugas*, including the villages of the Benares estate, as well as blocks in the Auraiya *kharka* belonging to His Highness the Maharaja of Benares, the Raja of Bhareh, the Raja of Jagammanpur, and others. It might further prove feasible to take up other *zamindari* land nearer to Etawah, especially along the Jumna to the west of the town.

20. As to the methods of acquiring management the Committee believe that in the *zamindari* areas arrangements might be made under section 38 of the Forest Act and that a similar course would be feasible in the *pattidari* villages with the Land Acquisition Act in the background. The Committee, however, deprecate the application of the Land Acquisition Act on any extensive scale when introducing management of ravine areas in the Etawah district. It is suggested that the opposition would to a large extent disappear if it were understood that the record of proprietary rights would remain unchanged, and that the real solution of the difficulties connected with the introduction of a system of management which they believe to be of the highest value lies in the amendment of section 35 of the Forest Act by the addition of a sixth purpose, to wit, "for the formation of fuel and fodder reserves."

21. The Committee would point out that this proposal should be regarded merely as an initial step towards a much wider extension of the system. The suggested amendment of the law is, in their opinion, justifiable both in the interests of the individual landholders concerned.

22. The Committee would also suggest that enquiry be made at the earliest date as to the possibility of any measure by which the Forest department should take over the lease or the management of the reserve known as the Fisher forest. The desirability of

this course would be enhanced by the acquisition of control over the area extending westwards along the Jumna, to which reference has been made above. It is felt that the Fisher forest, having been separated entirely for a long period from any village, would prove of the greatest value as an experimental ground for further measure of development in the controlled area and for studying closely the effects of conservation.

23. The Committee generally accept the proposals of the Forest department in regard to the system of working, subject to the approval of the revenue officers in question concerning the allocation of grazing blocks and the fees to be levied for grazing and fodder. They desire in addition to suggest that efforts should be made to utilise waste water from the canals in the *kharka* tract along the north bank of the Jumna, not only in the Fisher forest but also in such places as may offer adequate opportunities.

24. Lastly, the Committee refrain at this stage from attempting any financial forecast. Details must be obtained from the Forest department after a close examination of the area recommended for treatment has been conducted. The Committee desire to add that they consider this initial demonstration to be of so great general value as to warrant the Government undertaking itself part of the cost and so making the conditions on which grazing and grass-cutting would be allowed as lenient as possible. In any case the proper working of the system can, in the opinion of the Committee, be secured only if it be placed under the charge of an officer of the Imperial Forest staff.

(Sd.) D. C. BAILLIE, C.S.I.,
Chairman.

APPENDIX VI.

Copy of letter no. 175-L. of 30th September, 1914, from the Chief Secretary to Government, United Provinces, to the Director of Land Records and Agriculture, United Provinces.

THE Lieutenant-Governor has recently been considering the subject of ravine reclamation on a large scale throughout the United Provinces. The ravine areas of the province are well-marked. They are not found on the great wandering rivers like the Ganges, Gogra or the Rapti, but they abound on the streams with more defined channels and high banks, like the Jumna, Sote, Chambal, and others in every part of the province. In some places the ravines are spreading much more rapidly than in others, but in all cases they result in considerable loss to the immediate neighbourhood. Where they are spreading they cause actual loss of cultivable land, and whether stationary or spreading they result in a rapid rush of water from the up-land which causes impoverishment of soil, loss of moisture, and a lowering of the water-level. The subject has been noticed by a series of officers, in the districts of the present Jhansi division especially, as shown in a note, dated the 17th October, 1913, prepared by the Commissioner of Jhansi, a copy of which will be sent to you subsequently.

2. In view of the above considerations His Honour has decided to arrange for a regular survey of the field for ravine reclamation. The field for such a survey is so large that it would, in His Honour's opinion, be better for the present to neglect such ravines as are stationary and to concentrate attention upon those areas where erosion is most wasteful. Experience has already been gained in the Etawah district of the method in which ravines may be treated by means of a series of embankments. In Etawah indeed the process has been designed largely with a view to the encouragement of grazing and afforestation, but the same system is equally applicable to the process of smoothing down and finally filling up of the hollows of ravine ground. The desirability and practicability of embanking the up-lands where the slope commences to steepen and thus preventing the impoverishment of the up-lands by the washing away of good surface soil into the ravines is a matter which has not received and should receive adequate consideration so as to prevent further erosion. From a general application of schemes similar to those now in hand in the Etawah district to areas in other parts of the province considerable benefits should result.

The return from such a scheme will take three forms—

- (1) the indirect saving which arises from the scouring and final disappearance of such excellent soil ;
- (2) the ultimate revenue from forest trees—babul, shisham, and no doubt others—which will grow on the embanked terraces ; and
- (3) the almost immediate value of grass and grazing which the embanking will produce. Beside these, it is possible that the work will raise the waterlevel in the neighbourhood, which is usually very low, and help the cultivator in this way as well.

3. With a view to carrying out the scheme detailed above the Lieutenant-Governor has decided to appoint Mr. A. W. Fremantle, at present principal of the Cawnpore Agricultural College, to study the operations now being carried on at Kalpi and in the Etawah district. Mr. Fremantle will work in direct association with Mr. Courthope as the representative and under the directions of the Director of Agriculture, and after having obtained preliminary ideas as to the methods of preventing erosion he will visit the other ravine areas ascertainable from gazetteers and district officers and will see how far they afford a field for the lesser but immediately important object of famine works and the ultimately more important object of putting a stop to general erosion. At the end of next cold weather Messrs. Fremantle and Courthope would submit a joint report on these two points. It will be impossible to cover the whole province, and the Jhansi and Agra divisions should, it is suggested, receive attention first ; then, the country cut by the Gomti river and its tributaries in Oudh.

4. Messrs. Fremantle and Courthope should consult the district officers and the Public Works departments as freely as may be necessary and it would be left to the Public Works department to make detailed projects of the works recommended by them.

5. Mr. Fremantle should therefore be instructed as follows. He should go to Etawah as soon as he is relieved of his duties at the Agricultural College, and he should there, in consultation with Mr. Courthope, study the methods of ravine reclamation now in progress. He should also, during this period, study the literature of the subject and correspond with Collectors with a view to making plans for a cold weather tour. During the first week or two of this tour Mr. Courthope should accompany Mr. Fremantle in order that both officers may come to a common decision as to the exact lines on which the survey is to be carried out. This portion of the tour will include a visit to Kalpi. During the remainder of the cold weather Mr. Fremantle will tour alone keeping in correspondence

with Mr. Courthope and more especially with the Collectors of the districts in which he is touring, will note on the opportunities for ravine reclamation generally in the areas he visits and incidentally will note special localities where projects for useful famine works in the way of reclamation of ravine land might immediately be prepared. Mr. Fremantle should keep in mind that though the ultimate object of his survey is ravine reclamation on a large scale an important immediate object is the provision of a series of useful famine works. In some parts the local landholders may be prepared themselves to undertake works of ravine reclamation by means of takavi loans in ordinary times or as "aided works" in times of famine. Enquiries should be made on these two points, as opportunity occurs, to ascertain what landholders think on the subject.

6. At the end of his tour, as already stated, Mr. Fremantle should, in conjunction with Mr. Courthope, submit a report for the tract visited on the possibilities of an extended campaign of ravine reclamation and prevention of erosion and the scope offered in this direction for useful famine works.

APPENDIX VII.

No. 971 OF 1914.

RESOLUTION.

FOREST DEPARTMENT.

Dated Allahabad, the 21st December, 1914.

READ—

- (1) Note, dated the 17th October, 1913, by H. C. Ferard, Esq., C.I.E., I.C.S., Commissioner, Jhansi division.
- (2) Report on the utilization of silt in Italy by Mr. C. H. Hutton.
- (3) Report on the *colmata di monte* of Italy by Mr. F. Clayton.

OBSERVATIONS.—The Lieutenant-Governor has recently had under consideration proposals to minimize the evils resulting from excessive erosion in the Bundelkhand division, in the districts of Muttra, Agra and Etawah, and in other parts of the province where ravine land exist. There can be no doubt that in these areas excessive erosion is taking place on a large scale and with very deleterious effects. With regard to the Jhansi district, for example, Mr. A. W. Pim, I.C.S., in his settlement report remarked:—“Most parts of the district are overdrained. In the high-lying tracts the natural soil is stony and excessively poor. In the more level plains is found the rich deposit which forms the characteristic black soil of Bundelkhand, but in the villages bordering on the ravines this is being scored and broken up by the surface drainage and the area of good soil is gradually diminishing The destructive influence of these *nullahs* is by no means confined to the land rendered unculturable by them. There more serious though less obvious effect consists in the gradual thinning of the upper stratum of good, black soil which is not being replaced in any way and which must lead to the gradual deterioration of the district though the process must be a slow one.” And similar references abound throughout the report. The streams of Hamirpur, says the gazetteer of that district, “though they provide a ready means of escape for the rainfall which is often heavy in the tract, are destructive and tend to spread. By denuding the surface soil in hilly tracts and by carrying off the organic matter and other soil constituents in the level plains they are constantly and steadily impoverishing the soil except where the land is protected by embankments.” With regard to Jalaun Mr. Hailey, I.C.S., makes the following remarks in his settlement report:—“As is invariably the case with high

land the upland which succeeds the ravines is poor in quality . . . It has a light-coloured hard soil, the most valuable properties of which are washed away by the downward flow of the rain water. Except in the north the gradual fall in the surface to the level plain of the centre can be clearly traced by the deepening in the colour of the soil." Similar remarks, which are reiterated with emphatic frequency in settlement reports and gazetteers, might be applied with equal force to Banda, Etawah and other districts of the province.

2. The deleterious effects of continuous erosion have long been recognized and from time to time schemes have been put forward and measures have been taken for their palliation or prevention. The earliest and so far the most effective form of action is that taken by the cultivators themselves in making small embankments across their fields at the heads of the ravines. Mr. Alan Cadell, writing of the district of Banda, said :—"To the south of the old pargana of Sihonda and throughout the uneven portions of Badausa, embankments have been constructed with a persistent industry which was in the highest degree creditable to the inhabitants. Until one sees the never-ending succession of embankments which have created fairly fertile fields in the midst of broken ravine country it is difficult to realize that such barren looking tracts are capable of improvement which has been effected. What a few years ago were sandy ravines or stony watercourses became after a time fairly fertile fields." Similar action has been carried out by the cultivators of other Bundelkhand districts, but unfortunately through apathy or want of capital much work of a remunerative nature remains to be done, and there are also many areas which would be too expensive to reclaim. The remarks made in this connection by Dr. Voelcker in his book *The Improvement of Indian Agriculture* are so apposite as to bear quotation in full :—

"Reclamation of ravine land may take place in two different ways—either by covering it with trees, shrubs and grass or by making the land itself fit to bear crops . . . It is not often that land cut up by ravines can be levelled and the whole area be thus turned into a culturable space, but much can be done to localize the effects of the floods that wash down and sweep before them the fine subsoil. In many cases these floods can be prevented from spreading their destructive influence further and from impairing the lands that lie beyond them. The work of actually levelling ravines is too great and too expensive a one to contemplate, save in exceptional circumstances. Here and there an individual proprietor, having a large holding and also capital, may

do it, and Government may also initiate it as a means of protection or as 'famine work,' but it cannot be looked upon as remunerative. Much, however, may be done by throwing embankments across the *nullahs* or channels made by ravine streams, and thus holding up the water and preventing the continual washing away of the surface soil."

3. It has been seen that action in the sense indicated by Dr. Voelcker has for many years past been taken by the cultivators of Bundelkhand in respect of their small holdings. Occasional instances have also occurred where the energy and enterprise of more wealthy individuals have led to the inception of reclamation works on a larger scale. Thus many years ago Captain Chapman, the owner of an estate on the banks of the Ganges through which ran a moderately high cliff—the further bank of the river—made a successful attempt to regulate the drainage which was cutting up his fields at the edge of the cliff. By a system of small dams across the ravines, supplemented by terracing, the further erosion of the upland was checked and the letting value of the fields was greatly increased. Again, an assistant of the United Provinces Agricultural department, who had watched certain experiments in ravine reclamation made by Sir Edward Buck—then Director of the department—rented some waste ravine land in the neighbourhood of Cawnpore, and by the erection of *bundhs* and terraces succeeded in quintupling the value of the estates. Guided by these examples it was not unnatural that the Local Government should turn its attention to the possibility of making similar experiments with the object of inducing landholders and others to extend this form of improvement to their own lands. As early as 1887, on the advice of Mr. Ward, Commissioner of the Jhansi division, the Local Government decided to make an allotment for the experimental reclamation of waste land in that division by the construction of *bundhs* across the ravines to hold back the drainage water. Similar experiments are still being continued by the Agricultural department of this province. But all these experiments have been somewhat intermittent in their nature and have been made without any reference to a defined policy of reclamation.

4. For an instance of organized effort to solve the problems of erosion it is necessary to go to Italy and to study what has been accomplished in that country under the name of *bonificazione*. In Italy the work of *bonificazione* has taken two main forms. Firstly and mainly for the improvement of hygienic conditions and the fertility of the soil in lowlying areas, and secondly for the prevention of erosion and the filling up of ravines already formed in hilly tracts. The first of these two branches of activity has been undertaken in

Italy on a very large scale and with beneficial results of considerable magnitude, but it need not be touched upon here. The second form of *bonificazione*, however, is of great interest in connection with agricultural improvement in the hilly or undulating tracts of this province. The system of reclaiming rugged land by means of embankments and silt deposits is technically known as *colmate di monte* or building up of the hill, and has been adopted in Italy with much success for many years. This system consists essentially in the digging of drains along the contour lines of the hills, so that both surface water and the silt borne by such water are caught in the drains. These drains are cleared out once a year and the silt deposit in them is thrown out on the down-hill side and ploughed in; the ploughing being done in such a way as gradually to work the soil down to the lower portion of the strip and thus to make the strip more level. In the course of years of such treatment these strips become level terraces. With regard to the ravines which scour the surface of the Italian hills it is usual to make across the ravines a series of small banks, beginning from the top and working gradually downwards. When rain falls pools of water form rapidly behind the uppermost embankments which serve a comparatively large catchment area. As each pool fills the water escapes and is retained by the embankment next below until perhaps all the embankments have pools behind them. By such means the ravines gradually become silted up, providing fertile terraces on which trees, grass or crops may be sown and generally hold up the water-level of the neighbourhood. Parts of the hill which were formerly precipitous and unculturable come under the plough and bear crops, and thus both the area and the quality of the soil is increased.

5. The work thus carried out in Italy was brought to the attention of the Government of India by Sir Colin Scott Moncrieff and Sir Edward Buck, at one time Director of Land Records and Agriculture in this province. As a result of the interest aroused by a report on this subject by Sir Edward Buck the Government of India suggested that the question of *bonificazione* in the United Provinces should be considered and that one or two officers of the Public Works department might be deputed to Italy for a short period to study the methods utilized in that country. Accordingly Messrs. Hutton and Clayton of the Irrigation branch of the Public Works department of this province were deputed to visit Italy in the year 1907-8.

6. The history of Government activity in this matter is therefore a short one and little work has as yet been done. Works of considerable importance however have been carried out in

Bundelkhand, where, as already stated, the construction of field embankments has for many years been utilized by the cultivators for the improvement of their fields. In 1905 a tank division of the Irrigation branch was formed for the special purpose of projecting and carrying out works of this nature. This division was abolished on the constitution of the Jhansi division of the Betwa canal and of the Ken and Dhasan canal divisions which provided a staff sufficient for all schemes within their respective areas; but the work has been carried out with energy and has comprised the preparation of projects and the supervision of the building up of numerous field embankments or *bundhis* which in their beneficial effect in preventing surface erosion resemble the *colmate di monte* of Italy.

7. Such operations on a large scale are of course very expensive, and it is therefore probable that unless the landholders can be induced to undertake for themselves the reclamation of at least some of ravines which now carry away the most fertile portion of their soil no very great advance can be made except during times of famine, when the Local Government has in any event to provide work for the relief of distress. Works of this nature have actually been carried out under the supervision of the Forest-department in the Etawah district during the recent famine and are reported to be admirably suited for famine works. The objects of the operation in the ravine tracts in the Etawah district are as follows :—

- (1) To prevent the further erosion of the ravines, that is, the scouring out of the bed and the banks of the ravines.
- (2) To check, and finally altogether stop, the further extension inland of the ravines.
- (3) To prevent the good soil being washed off the upland fields and carried away down the ravines to the rivers.
- (4) To retain the rainfall which at present runs straight off the land into the rivers, and thus to retain moisture in the soil and raise the water-level.
- (5) To improve the pasture and tree growth on the ravines and thus to establish fuel and fodder reserves.

The experiments which have been made for this purpose in the Etawah district are as yet in an undeveloped state, but the results which have been attained, more particularly as to the growth of grass on treated areas, are highly satisfactory and promise good results on the upland areas to which such treatment may be applied elsewhere.

8. In this Government's resolution no. 348, dated the 26th August, 1912, stress was laid upon the importance of developing the waste lands of the province, but no allusion was made to the special desirability of reclaiming ravine land as such. Sir James

Meston considers, however, that, quite apart from the formation of fuel and fodder reserves, attention should be paid to the reclamation of such lands, as their existence involves not only a loss to the possible present assets of the province but also implies a progressive deterioration in the future of its existing assets. Moreover, work in ravine lands constitutes a most useful and almost inexhaustible opportunity for the employment of labour in times of scarcity. His Honour has therefore decided to investigate the possibilities for the reclamation of ravine lands in the United Provinces with a view not only to the provision of suitable famine works but also to the prevention of the extension of such ravines, the improvement of the upland soil, the raising of the water-level and the provision of fuel and fodder supplies. For this purpose he has deputed Mr. Fremantle, late Principal of the Agricultural College, Cawnpore, to make a survey of the ravine lands of the province in close co-operation with Mr. Courthope, the afforestation officer. The instructions issued to Mr. Fremantle were as follows:—He was to go to Etawah and there, in consultation with Mr. Courthope, study the methods of ravine reclamation now in progress. He was also, during this period, to study the literature of the subject and correspond with Collectors with a view to making plans for a cold weather tour. During the first week or two of this tour Mr. Courthope was to accompany Mr. Fremantle in order that both officers might come to a common decision as to the exact lines on which the survey was to be carried out. During the remainder of the cold weather Mr. Fremantle was to tour alone, keeping in correspondence with Mr. Courthope and the Collectors of the districts in which he was touring, noting on the opportunities for ravine reclamation generally and incidentally recording the special localities where projects for useful famine works in the way of reclamation of ravine land might be prepared. Mr. Fremantle was to keep in mind that though the ultimate object of his survey was ravine reclamation on a large scale an important immediate object was the provision of a series of useful famine works. In some parts the local landholders might be prepared to undertake works of ravine reclamation by means of *tagavi* loans in ordinary times and enquiries were to be made in this regard.

9. The Lieutenant-Governor desires that the work of ravine reclamation alluded to above shall be closely associated with the work of afforestation described in this Government's resolution no. 348, dated the 26th August, 1912, and he therefore takes this opportunity of expressing his wishes as to the course which should be followed in pursuing the policy of afforestation promulgated by Sir John Hewett. In paragraph 13 of the resolution referred to

above it was pointed out that afforestation was a branch of a science of which officers in the Forest department had little experience; and it was definitely stated that, even though the operations might extend so far as to necessitate the creation of a afforestation branch of the department, it was not the intention of Government that the department should, as a general rule, manage the forests which local bodies or zamindars might establish but rather that it should advise the owners in the methods of management when asked to do so. It has been suggested that at the present juncture it is useless to expect private owners themselves to do anything towards developing their waste land and therefore unless Government undertakes direct action for the purpose of afforestation no advance will be made. With the example of the Fisher forest before him, however, Sir James Meston cannot accept this statement of the position, and he hopes that persuasive treatment and the object lessons provided by successful Government plantations will induce many other individuals or local bodies to follow the example of the Etawah zamindars. In sanctioning the formation of the Etawah forest division, the main object of which is to manage under agreement the waste lands of the local landholders, His Honour had no intention of departing from this general principle. The action taken in Etawah was taken for special reasons, partly in order to provide exemplary plantations on a large scale, partly in order to check the devastating erosion which is continuous in the Jumna-Chambal tracts of the district and partly to develop the industry of grazing which is specially suited for this backward tract of country. As regards the general policy of the afforestation division however His Honour adheres to the principle that direct action is not desirable. It must not be overlooked that the question of afforestation is largely one of economic conditions. From the first it was clear that with ample staff and money, trees could be grown almost anywhere except perhaps on bare rock. The object of the afforestation officers must be not to confirm what is already known but to ascertain whether, in existing economic conditions or in the near future it is possible to establish fuel and fodder reserves which will cover their cost either directly or indirectly. The policy of Government at first must be to maintain experimental plots so as to obtain the requisite sylviocultural or other experience, to undertake a few reserves in suitable situations as examples to the people, and finally to search out those areas where the sentiment of the landholders, the existence of a demand for grass or fodder and other conditions are favourable to the formation of reserves. In those areas attention should be given to enlisting the sympathies of the people and to inducing

them to call in the aid of the department. It is the intention of Government, in fact, to proceed along the line of least resistance; to persuade and to help where help is asked for. It is not intended to acquire wholesale and to obtain legal powers to compel unwilling landowners. Such a policy might possibly be successful from a financial point of view, but it would involve the Government in an enterprise far beyond anything which could be attempted with its present resources and would entirely fail to ensure the object aimed at.

APPENDIX VIII.

Report on the reclamation of the ravine lands in Bundelkhand and Muttra districts.

The investigation, of which the following is a report, was made under instructions contained in G. O. no. 175-L/XIV, addressed to the Director of Land Records and Agriculture, United Provinces. At the end of October Mr. Fremantle joined Mr. Courthope at Kalpi and studied the results obtained from the construction of numerous small *bundhs* by Mr. Hobart Hampden, and a few larger *bundhs* recently constructed, and the effect of nine years' protection from grazing. From Kalpi Mr. Fremantle and Mr. Courthope went to Etawah where they were joined by Mr. Clutterbuck, Conservator of Forests, Eastern circle: in this district they examined the work done in the Fisher Forest by the forest department and that done by famine labour at Chakernagar and Sahson. From Etawah the above three officers proceeded to the Hamirpur district, where they inspected the results of the experimental sowings in the land acquired for the establishment of babul plantations, as well as the *bundhs* constructed in the Bandhar Bazurg block, from the failure of which some useful experience has been gained. At the beginning of December Mr. Fremantle and Mr. Courthope separated, having agreed that Mr. Fremantle should make a systematic survey of the ravine country on the banks of the Barma, Betwa and Dhasan rivers in the Hamirpur, Jhansi and Jalaun districts, and that Mr. Courthope, who had received separate instructions to report on the Bhadawar estate in the Agra district, and who had also to carry on his duties as Officer-in-charge of the Afforestation division, should examine the possibilities of ravine reclamation in the Agra and Muttra districts.

2. Mr. Fremantle and Mr. Courthope began their investigations under the impression, conveyed in G. O. no. 173-L/XIV, that Government intended them to enquire into the possibility of the extension of operations for the reclamation of ravines on precisely the same lines as those already suggested and approved by the Government in the Etawah district, that is, that they were, in the first place, to examine into the suitability of different blocks of ravines for reclamation by *bundhs* and afforestation, and, in the second place to ascertain whether *zamindars* are willing to carry out the work at their own expense with the help and advice of the afforestation officer or to hand over their land for management,

as has been done by the *zamindars* of the Etawah district. Mr. Fremantle and Mr. Courthope also understood that they were to enquire to what extent the local landholders themselves would be willing to construct field embankments on the more gently sloping uplands with a view to prevent the wastage of good soil and the prevention of further erosion. These impressions were confirmed by the report of His Honour the Lieutenant-Governor's speech to the Durbaris of the Jhansi division on 22nd December, 1914, in which he states that he hopes the landholders will be partners with Government in a scheme for reclaiming ravine lands on a large scale, and that, if they will give the land and forego to some extent their grazing rights for a period, Government will provide the initial cost: in his speech he indicates that the object of the scheme is, firstly, to reclaim the existing ravines, secondly, to prevent their extension and, thirdly, to establish on the land thus reclaimed valuable fuel and fodder reserves.

3. The writers were somewhat confused, therefore, by the appearance in the Gazette of resolution no. 971, dated 21st December, 1914, for, while up to paragraph 8 it confirmed these impressions as to Government's intentions, in paragraph 9 it is stated that, "with the example of the Fisher forest before him Sir James Meston is not satisfied that landholders cannot be induced to follow the example of the Etawah *Zamindars*" and to afforest their own land, and it is indicated that the action now being taken in Etawah was taken for special reasons and is not to be regarded as a suitable way of dealing with other areas. This resolution therefore practically states that Government is not willing to undertake the departmental management of ravine areas, but is only willing to help the landholders with advice, and definitely states that direct action is "not desirable." It is further stated that the policy of the Government must be to maintain experimental plots and to undertake a few reserves in suitable situations as examples to the people and finally to search out those areas where the conditions are favourable to the formation of reserves. But the resolution concludes with a statement that, while it is not intended to acquire land wholesale or to obtain legal powers to compel unwilling landholders, it is the intention of the Government to proceed along the lines of least resistance and to persuade and to help where help is asked for, which is exactly what Government is doing in the Etawah district.

4. Being unable to reconcile these apparently contradictory policies, Mr. Courthope consulted Mr. Ferard, Commissioner of the Allahabad division, with whom he was touring at the time, and Mr. Ferard thought it necessary to refer the question to the Chief

Secretary, asking whether it was to be assumed that Mr. Fremantle and Mr. Courthope should first endeavour to induce landholders to reclaim and afforest ravine lands at their own expense and that, if they expressed their unwillingness or inability to do so, they should suggest to them that they should make over such areas to be dealt with departmentally. The reply received on 11th February, 1915, may be summarized as follows: Government does not contemplate taking over and managing further areas till the Etawah scheme has justified itself, but is willing to advise and help landholders without undertaking financial responsibility: in other words the Chief Secretary's reply repeats the gist of paragraph 9 of resolution 971, but does not reconcile it with the Lieutenant-Governor's appeal to the landholders of the Jhansi district to hand over their lands for reclamation purposes, or with G. O. no. 175-L/XIV. The writers of this report therefore think that the ultimate policy of Government is as yet undefined and think it is possible that Government is awaiting the receipt of this report before coming to a final decision, and they therefore thought it wiser at this late stage of their investigation that they should pursue their enquiries on the lines agreed upon in November, 1914, that is (1) to examine into the possibilities of schemes for the reclamation of ravine lands in different localities, (2) to enquire as to the willingness of landholders to undertake such schemes in co-operation with each either at their own expense or by *tagavi* loans or to hand over such areas to Government for management, (3) to ascertain to what extent the landholders would be willing to make field embankments on the gently sloping uplands with the help of *tagavi* loans, and (4) to ascertain how far reclamation of ravines is suitable for famine works and to suggest localities in which projects for such works might be drawn up.

5. In carrying out this investigation the following localities have been visited and examined by Mr. Fremantle:—

- (a) Both banks of the Barma river with its tributaries from 10 miles south of the Rath-Muskara road to the junction of the Betwa and Barma rivers in the Hamirpur district ;
 - (b) Both banks of the Dhasan river and its tributaries from Rora to its junction with the Betwa in the Hamirpur and Jhansi districts ;
 - (c) Both banks of the Betwa from Paricha to Hamirpur town in the Jhansi, Jalaun and Hamirpur districts ;
 - (d) a block of ravines on the Jumna near Kalpi ;
- and by Mr. Courthope the ravines of the Jumna and Chambal rivers

in the Agra district and certain waste lands on the bank of the Jumna river in the Muttra district.

6. *The possibilities of the schemes of reclamation.*—It is now generally admitted that all ravines can be reclaimed and that the further extension of ravines can be prevented ; further it is admitted that fuel and fodder reserves, or even gardens, can be established on the reclaimed land provided enough money is expended. In G. O. no. 175-L/XIV, dated 30th September, 1914, it is stated that the returns from such schemes will take three forms—(1) the ultimate revenue from forest trees, (2) the immediate value of grass and grazing which will result from the reclamation, and (3) the indirect saving which will arise from the prevention of scouring and ultimate disappearance of much excellent soil. In the opinion of the writers to these returns must be added (1) the very large saving which Government will effect in times of scarcity and famine by having a stock of fodder in the impoverished districts instead of having to import it from great distances, (2) the indirect returns due to the saving of cattle manure for the fields as insisted upon by Dr. Voelcker, and (3) the indirect increase of revenue to Government which must follow upon the increased prosperity of the inhabitants of the locality.

7. Dealing first with the commercial possibilities of the scheme generally, that is to say, with the sources of direct revenue as compared with the expenditure, the chief factors necessary for success are a sufficiently large area and accessibility. To reclaim even a small area a permanent establishment of trained employees must be maintained, but this same establishment can supervise a very large area. There are not at present sufficient data to enable the writers to state definitely what the cost of reclamation will be, but they believe that they are not being over sanguine in estimating the cost at about Rs. 25 per acre, excluding the cost of establishment. The additional cost per acre for establishment depends entirely on the amount of ground annually reclaimed : it has been estimated that the annual cost of the full establishment for reclaiming and managing 25,000 acres in the newly formed Etawah division will be about Rs. 25,000, though there is reason to hope that it may be rather less. Assuming that only 1,000 acres per annum were reclaimed, the cost for establishment would be Rs. 25 per acre and the whole cost Rs. 50 per acre, and the writers think that this figure may safely be taken as a maximum, provided the schemes are on a sufficiently large scale. It is to be noted that this figure includes the cost of reclaiming the ravines and establishing and maintaining plantations thereon.

8. It is obvious that the direct returns from the sale of the produce of any plantation must vary with the distance of that plantation from the chief markets and from the railways and roads by which those markets are reached. The main sources of revenue from plantations established on ravines will be (1) timber, (2) firewood and charcoal, (3) babul bark, (4) hay, (5) grazing dues, (6) minor produce, such as mahua fruit. It is also hoped that it may be possible to grow bamboos, for which there would be a great demand. As far as is known at present, the only large timber tree which would be grown on the ravine tracts is shisham, for which there is an almost unlimited sale, but there can be little doubt that other timber trees will be found suitable. Many species of trees which will produce small round timber can be grown. Timber, both large and small, would probably find a market even in plantations situated at considerable distance from the main lines of communication. Fuel, however, will only be exported from plantations situated quite close to railway lines, except in the case of babul plantations from which purchasers will buy wood together with the bark if situated within about 15 miles of a railway line. In ordinary years the demand for hay is strictly limited and it can only be exported to the markets in large cities from areas close to a railway line. In times of scarcity, however, the demand for hay is very great, and it can be sold at Re. 1 to Rs. 2 per maund in the district, while in the cities even higher prices can be obtained. The yield of hay in the Kalpi plantation in a dry year was 10 maunds per acre, and there is no reason to suppose that it would be less in other ravines. Assuming that only half of the reclaimed area were closed to grazing during the rains, it may safely be assumed that the profits from the sale of grass would be Rs. 4 or Rs. 5 per acre over the whole of the reclaimed area, and, assuming that such years of scarcity occur once in every five years, the annual revenue from the sale of grass would be about Re. 1 per acre, even if no grass were cut and stacked in good years for sale in time of scarcity. The demand for grazing varies in different districts. In those tracts in which the cultivation is intense the demand is great owing to the fact that the area available for grazing is limited. In such tracts as those along the Dhasan river, however, there is so much waste land as compared with the area under cultivation that it is probable that in ordinary years the cattle-owners would prefer to graze their cattle free on inferior pasture to paying fees for the privilege of grazing on the improved areas. Grazing dues therefore must be looked upon as an asset of the more accessible forests only. Calculating that the crop of trees in the plantations established on reclaimed ravines in accessible areas would be worth Rs. 100 per acre

after 20 years, the annual revenue to be derived from the plantations may be calculated roughly as follows :—

			Rs.	a.	p.	
From the sale of timber, firewood and bark	...		5	0	0	per acre
From the sale of hay	...	...	1	0	0	" "
From grazing dues	...	...	0	8	0	" "
Total	...		6	8	0	

In inaccessible areas, that is areas situated at a distance from the railways and unprovided with good roads, the revenue may possibly not exceed Re. 1-8-0 or Rs. 2 per acre per annum.

On the other hand, taking the estimate for the Etawah division as a guide, the expenditure is likely to work out at about Rs. 2 per acre per annum.

9. The writers, therefore, are of opinion that the financial prospects of fuel and fodder reserves established on reclaimed land within 15 miles of a railway are decidedly good, but that, on the other hand, the reclamation of ravines in more remote localities is not likely under existing conditions to prove a success looked at from a purely financial point of view, without taking into consideration any indirect return, credit for which could not be shown in the balance-sheet. At the same time it must not be overlooked that in the more remote localities forest officers would naturally sow mainly timber trees which it would pay to export from greater distances, that, in these days of progress, remote localities may be rendered accessible by means of tramways and other means of mechanical transport, and that factories for the manufacture of such products as tannin extract or wood spirit or matches might be established, thus rendering the reclamation of these remote areas also a profitable investment.

10. In the last few paragraphs the possibilities of ravine reclamation have been examined from a strictly financial point of view. There still remain to be considered those indirect returns suggested by G. O. no. 165-L/XIV and those additional indirect returns suggested in this report. G. O. no. 175-L/XIV refers to the saving which will be effected by the prevention of the loss of much excellent soil. The process of erosion is apparently so gradual that it is probable that it is not generally realized how enormous this loss really is. Some years ago some figures appeared showing the enormous amount of soil which was scoured out by an American river. The writers cannot produce accurate figures to show the extent of the damage done by the rivers of these provinces, but in his report for the Bhadawar estate in the Agra district Mr. Courthope calculated that the annual loss of cultivated land in

the Etawah district was about 250 acres and in the Bah tahsil of the Agra district about 160 acres. In the Jhansi district Mr. Fremantle found one village of 925 acres, in which during the last 24 years the cultivated area has decreased from 464 to 335 acres, and the revenue from Rs. 800 to Rs. 585. In another village of 1,500 acres, the cultivated area has decreased in the last 40 years from 911 to 560 acres, while in the last 24 years the decrease has been from 743 to 560 acres, the revenue decreasing in the same period from Rs. 1,410 to Rs. 905. It is probable that this decrease in the cultivated area is due either directly or indirectly to the encroachment of the ravines. It is to be noted that the figures given for the area now under cultivation are based on the average for the last three years, and that the revenue mentioned is that given in the latest five years' settlement.

It is quite certain that the annual loss of land throughout the provinces is very large indeed. This loss of land constitutes a direct loss of revenue to Government, and consequently, in considering the financial possibilities of any scheme which will arrest and finally stop this regular loss of revenue, the annual revenue of the land, which would otherwise be lost, should be shown on the credit side of the balance-sheet. It is to be noted that this form of indirect returns affects Government and landholders alike.

11. The savings effected in the time of scarcity owing to there being a growing crop and possibly a stacked reserve of fodder in the districts instead of this fodder having to be brought from great distances would be very large. The famine report for 1913-14 has not yet been published, but it is believed that Government incurred an expenditure of about Re. 1 to Re. 1-4-0 per maund of hay exported to impoverished districts, while only six annas of this was recovered from the consumers, so that the nett loss was about annas 12 per maund. The grass imported from the submontane districts was coarse and inferior while the grass which can be grown on reclaimed ravines is excellent. Not only would Government effect the saving of 12 annas per maund of the grass which hitherto has had to be brought from the submontane districts, but the superior grass would be eagerly bought by the owners of cattle at about Re. 1 per maund, to the advantage of the landholders concerned.

12. The next consideration is the saving of cattle. This also affects both Government and the landholders. The mortality of cattle leads to decrease in cultivation and consequently to a decrease in revenue. It is well-known that, in spite of the importation of fodder by Government a very large number of cattle are lost during each famine, as a reference to the District

Gazetteers will show. The figures for the last cattle census have not yet been published, but there is every reason to believe that this will show a further decrease in spite of the fact that the previous census was also taken after a year of scarcity. The *amindars* in the various districts visited in Bundelkhand give the loss of plough cattle, due to the scarcity of fodder, as one reason for the decrease of area now under cultivation.

13. Looked upon in this way the reclamation of ravines may be considered both by Government and by landholders as a kind of insurance against loss in times of scarcity and as a land-protective measure, and, as such, the writers have no hesitation whatsoever in strongly recommending it even in the most remote localities. The localities dealt with in this report are divided, as shown below, into two classes--(A) those in which the work of reclamation is likely to prove actually remunerative and (B) those in which it is to be considered as a protective work only:—

(A)—The ravines of the Dhasan river from Rora to Gurha and a small piece near the junction of the Dhasan and Betwa rivers.

All the Betwa river ravines below the Paricha dam, except a small area on the left hand east of Mohana ferry, and the ravines on the right bank from Chandaut to Parsani.

Most of the Jumna and Chambal ravines in the Bah tahsil of the Agra district.

(B)—The ravines of the Burma river.

The ravines of the Dhasan river from Gurha almost to the junction of the Dhasan and Betwa rivers. The ravines on the left bank of the Betwa river east of Mohana and on the right bank from Chandaut to Parsani.

The more remote ravines of the Jumna and Chambal rivers in the Agra district.

NOTE.—The ravines of the Jumna river in the Muttra district are not included in the above classification as they are of quite a different character and are not suitable for reclamation in the same way as the others referred to.

14. *Opinion of landholders.*—It must be admitted that the proposal to reclaim and afforest ravine tracts is not received enthusiastically by landholders generally, although there are indeed, a few enlightened exceptions who realize that these tracts are at present absolutely useless and that, if reclaimed, they are capable of affording good pasture to the cattle as well as bringing in

revenue to their estates. The main reasons given by the landholders for their objection to the proposal are as follows:—

- (1) *Want of ready money.*—It is a well-known fact that the landholders of these precarious tracts are not in a sound financial position, even the larger *zamindars*, such as the Raja of Gursarai, being involved in debt, and it would seem obvious, therefore that any scheme which does not bring in an immediate return is impracticable. But no such objection can be urged against such a scheme as that which has been proposed for the *zamindars* in the Etawah district in which Government has agreed to assume the entire financial responsibility.
- (2) *Disbelief in the financial success of the scheme.*—There is nothing to show the landholders that the scheme is likely to be a success, as financial forecasts convey nothing to them and no such scheme has hitherto been attempted on a large scale. It is only when they can actually see the improvement effected on some ravines in their own neighbourhood that they will begin to believe in the possibilities of the scheme. This objection also may be met with the reply that, even if proved a financial failure, a scheme such as is proposed for the Etawah division would not involve the *zamindars* in any loss.
- (3) *Want of labour.*—In many of these tracts labour is undoubtedly scarce and it is perhaps, only natural that the landholders should object to any scheme which is likely to take the labourers from the fields, more especially as it is a fact that the work of afforestation does require more labour just at the time when agricultural operations also require it, that is at the beginning of and immediately after the rains. On the other hand, it should be remembered that reclamation will provide work for labourers throughout the year, and is likely therefore to check the emigration of villagers to the cities and to the canal irrigated tracts.
- (4) *The fear of decrease of cultivation.*—This would at first appear to be a somewhat anomalous objection to raise against a scheme which aims at the prevention of loss of cultivated area. In these tracts, more especially in Bundelkhand, a portion of the land is cultivated by tenants who live in neighbouring villages, where

there is little land available for grazing, and the landholders fear that these tenants would abandon their holdings if grazing facilities and other amenities were in any way restricted or curtailed. It should be quite possible however to manage the land in such a way that the restrictions should be so light as to impose no hardship, while it is quite certain that the quality of the grazing will be improved.

- (5) *Friction with tenants.*—The *zamindars* are afraid that for the same reasons the scheme would result in resident tenants becoming discontented and that it would undermine their influence. The remedy for this would also lie in tactful management.
- (6) *Fear of oppression by subordinate officials.*—This objection is based on the assumption that the management would necessarily be departmental. Even if this were so, it must be remembered that there would always be a responsible officer within easy reach, and that afforestation charges can never be of the unwieldy size of ordinary forest divisions.
- (7) *Distrust of Government intentions.*—The landholders in Bundelkhand are convinced that Government wishes to take from them their proprietary rights in the land, and the Collector of Muttra told Mr. Courthope that similar rumours had been spread in that district. Such rumours always do arise whenever a Government officer examines the suitability of *zamindars'* land for any purpose. In any scheme of co-operation between Government and the landholders, such as that inaugurated in the Etawah district, the objection is fully met by a definite clause in the deed of agreement, but it must be understood that this last objection constitutes the chief reason for the hostility of the landholders to the proposal, though it is mainly based on sentimental grounds. This is specially the case among the Thakur community.

Other objections of a petty nature have been raised, such as the closing of roads, but none which cannot be met by mutual agreement.

15. *Agency of reclamation.*—There are several methods by which effect could be given to the general proposal to reclaim and afforest ravine tracts and the writers will now discuss the merits and demerits of each method which at first sight seems feasible.

16. *Reclamation by landholders at their own expense.*—Either

singly or in co-operation with each other. From the point of view of Government this would be the most satisfactory arrangement. That is to say, if landholders could be found in one district or even two adjoining districts, whose ravine tracts aggregated about 30,000 to 50,000 acres, and if this area is made up of large blocks of ravines of from 8,000 to 10,000 acres each, and if these landholders can find between them a sum of from 60,000 to 1,00,000 rupees annually, and can afford to wait 10 to 20 years before getting a return on their money, then a separate division could be formed and the whole expenditure would be borne by the *zamindars* themselves. This is an ideal arrangement which it is at present useless to contemplate. In the Agra district there is the case of the Bhadawar estate, at present under the management of the Court of Wards, which could afford to spend about Rs. 15,000 per annum on reclamation. Adjoining this estate there is a small estate of perhaps 3,000 acres of ravines, the owner of which has tentatively suggested that he might be able to afford Rs. 1,000 annually, if he were satisfied that the money would be well invested. At some distance from these two estates there is another landholder who has expressed his willingness to have a small area afforested as an experiment. These three estates together are not enough to form a division, though it may be possible to form them into a sub-division of the proposed Etawah division. The other landholders of the Bah tahsil, in which there is a large enough tract of ravines to form a division, are not in a position to find the necessary money even if they were willing to co-operate in the scheme. In Bundelkhand Mr. Fremantle finds that the larger landholders are not in a financial position to enable them to contemplate the possibility of reclaiming their ravines at their own expense and that, although certain smaller landholders are willing to spend a small amount each year on reclamation, the estates of these small *zamindars* are so scattered as to preclude the possibility of co-operation.

17. In resolution no. 971 it is stated that, with the example of the Fisher forest before him, His Honour the Lieutenant-Governor is not satisfied that landholders will not afforest their ravine tracts at their own expense. In the writer's opinion the example of the Fisher forest is not a fair one. The area is a very small one, and in itself is not enough to form a division or even a sub-division, and it would be quite impossible for any officer to supervise properly works of afforestation being carried out in a number of such blocks situated a great distance from each other even if the landholders had sufficient technical knowledge to enable them to carry out the works recommended. From the short history of the Fisher forest given in resolution no. 348, dated the 26th

August, 1912, it would appear that the landholders spent only a comparatively small sum of money in afforestation or reclamation and it must be assumed that the greater part of the forest growth was either present on the ground before the area was reserved or sprung up naturally as a result of preservation. Such natural growth is practically useless from a commercial point of view. To reclaim and afforest the Fisher forest, as it is now proposed to do, will cost about Rs. 6,000 annually. In the same resolution it has been shown that the *zamindars* after a very few years of management were able to lease the forests to Messrs. Cooper, Allen and Company at Re. 1 per acre per annum. Messrs. Cooper, Allen and Company having extracted all the babul trees which they could find on the ground, during the first ten years of their lease, were only too anxious to be released from their contract, as they found that it was impossible for them to manage such a small area economically, and it is quite certain that the firm would not again enter into such an undertaking.

18. The result of Mr. Fremantle's and Mr. Courthope's enquiries from the *zamindars* and the Collectors in the Jhansi, Hamirpur, Jalaun, Agra and Muttra districts is exactly the same as that reported in 1913 by Mr. Courthope, namely, that there is no hope of *zamindars* doing anything towards reclaiming and afforesting their lands of their own free will, at their own initiative and at their own expense *at the present juncture*. All Collectors agree in stating that if anything is to be done, Government must first show the way by establishing profitable plantations—profitable, that is, from either a financial or protective point of view—in each district.

Reclamation by Government, who might either acquire or lease the land and manage it through the agency of one of its departments, either as a protective measure in the interests of the general community or as a profitable investment. As recognized in resolution no. 348, dated the 26th August, 1912, a time has been reached in the economic development of these provinces when something must be done to utilize the vast area of waste land from which neither Government nor the *zamindars* derive any revenue. If Government is satisfied that, for this reason, and with the object of preventing the further waste of good cultivated land and consequent decrease in revenue, it is essential that the ravines should be reclaimed, and, if it can be done in no other way, Government can only have recourse to one or other of these measures. There is no doubt that, looked at from a strictly commercial point of view, acquisition of the land would be the most profitable course for Government to adopt, and, where it is possible

to obtain large tracts of such waste land without unduly injuring the interests and sentimental susceptibilities of the landholders, it is the course to be recommended before all others. On the other hand, by taking the lease of such land Government could obtain absolute control of larger areas without incurring the large initial expenditure necessary for acquisition and without depriving landholders of their proprietary rights to which they attach so much importance.

19. *Reclamation by co-operation* between Government and the landholders as is being done in the Etawah district and as His Honour the Lieutenant-Governor has suggested to the durbaris of the Jhansi division. Under this method Government recognizing the inability of the majority of landholders to find the necessary funds for the works of reclamation, would be prepared to incur all the necessary expenditure and to reimburse itself from the first profits obtained from the reclaimed area, while after the capital expenditure incurred had been paid off, all further profits would be paid over to the landholders themselves. At first sight this may appear to be a somewhat one-sided arrangement, in that Government takes all the risk of the scheme proving a financial failure, while, if it is a success, the landholder receives all the profits. But it must be remembered that, whether the scheme is a financial success or not, Government reaps the indirect advantages already referred to. Under this method of management the landholders voluntarily put their lands under the control of a Government department.

20. The writers are agreed that the scheme outlined by His Honour the Lieutenant-Governor at Jhansi is that which present the greatest advantages to the zamindars, but, in view of their enquiries in the districts, it would not appear that any considerable number of landholders at present realize these advantages sufficiently to induce them to make application under section 38 of the Forest Act, and they think it will be difficult to form divisions of manageable size from the lands of those willing to do so.

21. A scheme has been proposed for the reclamation of ravine tracts in the Etawah and Agra districts which combines the four methods outlined above for, under the management of the Etawah division, it is proposed to include (a) a small piece of land bought outright by Government, (b) the remainder of the Fisher forest which is held by Government under a lease, (c) the ravine tracts of landholders who have applied to Government for help under section 38 of the Forest Act, in which Government is to incur all the expenditure, and (d) the Bhadawar Estate in the Agra district, in which the estate proposes to find the money.

The writers are convinced that similar schemes might be prepared in the Jhansi, Hamirpur, and Jalaun districts, in each of which Government at present owns small areas, which cannot be managed economically in themselves.

22. *Reclamation by means of taqavi loans.*—During the course of his tour Mr. Fremantle met a considerable number of landholders who, although they were not prepared to give up control over any part of their ravine tracts, expressed their readiness to take steps to check the erosion of the cultivation by reclaiming and afforesting an adjoining strip of ravines by means of *taqavi* advances. Both Mr. Fremantle and Mr. Courthope are agreed that, while zamindars could construct field embankments by means of *taqavi* loans and should be encouraged to do so, and might also construct ravine *bandhs* as aided works in times of famine, it would be impossible for landholders to carry out the full work of reclamation, which includes afforestation, on *taqavi* loans, partly because they have not the requisite knowledge, and partly because it is unlikely that they would personally devote the time and care necessary for the supervision of afforestation work. As the present afforestation staff is not large enough to supervise a number of small works scattered about the districts, the writers do not advise that *taqavi* loans should be given for such work as a general principle until the staff is very much increased, but they think that a few such loans might be given as an experimental measure, in localities situated close to works now being undertaken departmentally on a larger scale, on condition that the work is carried out by the zamindars on lines laid down by afforestation officers.

23. In this connection Mr. Fremantle suggests an entirely new scheme. Hitherto the idea has been that operations in each estate, whether carried out by Government or by the landholders themselves, should be spread over a period of about 20 years, so that not only should the expenditure be distributed over a number of years, but that when the whole tract has been worked over, the receipts should constitute a regular income. Mr. Fremantle suggests that the Afforestation department should also work more on the lines of a firm of contractors, that is, they should reclaim and afforest a given block of ravines for a landholder as a single operation, and that, after the completion of the work, that is, perhaps, after two years, the responsibility of the department should cease. The expenditure incurred by Government would not be repaid by the landholder, unless he desired to do so, but he would pay a fixed annual rate per acre of land reclaimed, sufficient to cover the interest on the expenditure involved, including the cost of the establishment employed, which would probably amount

to Re. 1 or Re. 1-8-0. This procedure would be somewhat similar to the system under which inundation *bandhs* are made in Bundelkhand by the Irrigation department and an annual rate charged per acre of land affected. While Mr. Courthope is ready to admit that such a scheme has decided advantages, such as that Government incurs no risk of a financial failure and receives from the start a fair return on its money, he is of the opinion that few landholders would be likely to pay an annual rent or tax on their own land for the sake of protecting their cultivation on behalf, mainly, of their heirs. On the other hand, Mr. Fremantle thinks that some of those landholders who have expressed their readiness to take *tagavi*, on which they will have to pay 6 per cent interest, and which they would ultimately have to repay, and carry out the work of reclamation themselves would certainly be willing to let a department do the work without in any way assuming control of the land when the work has been done, if they only have to pay what corresponds to interest on the loan and were not compelled to repay the capital except at their own desire. Mr. Courthope thinks that, even if landholders were found, reclamation work done in this way would prove a failure because landholders would not take the trouble to maintain the *bandhs*, and that they would allow their tenants to ruin the plantations, as soon as they were established, by ruthless lopping and unrestricted grazing, and that even if the landholders were bound down to certain lines of management—a procedure of which Mr. Fremantle disapproves on the grounds that if the landholder is paying an annual rental for the reclamation he is entitled to treat his land as he pleases—it would require too large a staff to ensure the terms of the agreement being carried out.

Here, again, Mr. Fremantle does not agree, as he claims that a zamindar, who is paying for the successful reclamation of his land, is sufficiently alive to his own interests to maintain the improvement effected.

24. Mr. Fremantle considers this scheme applicable mainly to narrow strips of ravines running up from the main blocks of ravines into stretches of cultivation which perhaps it might not be possible to include in larger schemes, and also for the purpose of forming a narrow belt of afforested land across the heads of the ravines to protect the uplands from further erosion. Mr. Courthope admits Mr. Fremantle's contention that, if successful, this scheme would result in a larger area of cultivated land being protected at a smaller cost and more quickly than by reclaiming and afforesting compact blocks of ravines, but thinks that a special officer with a separate staff would have to be employed to supervise

such work. Mr. Fremantle is very strongly of opinion that an experiment on these lines should be undertaken.

25. *Reclamation by famine works.*—The writers think that there can be no doubt that the construction of a series of small *bandhs* in the ravines is a work which is eminently suitable for famine labour. In the first place it is a work which cannot be swamped and which can be adapted to suit either large or small numbers. In the second place it is a work which can be closed down immediately without leaving the work in an uncompleted condition and in the third place it is a work on which even the younger children can earn their daily allowance. In the Etawah district some work was actually carried out successfully in the recent famine, and it is believed that some officers of the Public Works department are now convinced that the work is suitable. In their opinion it is better adapted to Civil Works than to large Public Works and this is probably the case, but the writers think that it will be found that there are no insuperable objections to the work being done on a large scale also. They admit the difficulty of preparing detailed projects in advance, but fail to see the necessity for this. As far as they understand famine procedure, it is only essential that Government should be satisfied in advance that works have been provided sufficient to give labour to as many persons as are likely to seek employment, and that an estimate of the amount of money required should be prepared. From an experiment made by Mr. Courthope with an officer of the Public Works department—and other similar experiments could be carried out—it was ascertained that the average amount of earthwork per acre would be about 1,680 cubic feet, which is sufficient to keep about 80 persons, including quite young children, employed for one day. Assuming a famine work to continue for 150 days, a work extending over ravines aggregating 4,000 acres would be necessary for 2,000 persons.

But the writers also claim that famine labour can also be employed on other operations necessary for reclamation such as the breaking-down of ridges between ravines, and preparing ridges and pits for sowing and planting. Moreover, they claim that in areas already under the process of reclamation a very large amount of labour can be employed at ordinary rates in years of scarcity, thus in many cases probably avoiding the necessity of opening relief works.

26. The writers wish to lay special stress on one point, however, namely, the absolute necessity of Government assuming control, in some form or other, of all large blocks of ravines reclaimed by famine labour for which Government has paid or, in

other words, that no such work should be inaugurated in any land which does not belong to Government or in which Government has not obtained control by agreement with the landholders. For this reason they strongly recommend that, in anticipation of subsequent famines, Government should, as soon as possible, select certain areas in which to carry out works of relief, and that it should either acquire such areas, or lease them, or arrive at some agreement with the landholders concerned.

27. *Establishment necessary for reclamation.*—Whether Government undertakes the departmental management of ravine tracts for the purposes of reclamation, as suggested by His Honour the Lieutenant-Governor in his speech at Jhansi, or whether the zamindars can be induced to undertake the work at their own expense, it is obvious that there must be a supply of trained subordinates to supervise the work on behalf of either Government or the landholders. It is equally obvious that it would be impossible suddenly to train a large number of such men on the declaration of famine. The writers think therefore that a few remarks under this head will not be out of place in this report.

28 In the first place Mr. Courthope is strongly of opinion that all subordinates should be specially recruited and trained for this work of reclamation and afforestation and that, when this has been done, no more subordinates should be recruited from the Forest department. The excellent forest training given to provincial officers and subordinates at Dehra Dun College and the Ramnagar training class is to a large extent wasted on men whose work is to afforest waste land, and, although the services of officers recruited for the Forest department are entirely at the disposal of Government for any branch of forest work, it cannot be denied that provincial officers and subordinates would never be really contented to spend the rest of their service in afforesting bare ravines, while if officers after being trained in afforestation work are to be transferred back to ordinary forest divisions, the work of reclamation must suffer. There are three classes of men who will be required. In the first place in each block of about 2,000 acres in which work is being carried out there must be a man corresponding to a "forester," who will be directly responsible for carrying out the necessary operations correctly. From three to five of such small charges would be grouped under men of higher educational qualifications who would supervise all works, and two or three of these larger charges would be grouped under the control of an officer, corresponding in rank to an Extra-Assistant Conservator of Forests, who would work as a sub-divisional officer to the Afforestation officer and who would be provided with a small office establishment.

As regards the training of these officers the writers are of opinion that, while the lower-paid subordinates corresponding to foresters need only be taught the practical work by attaching them to existing works and making the officers in charge of these works responsible for their training, as is now actually being done, a class should be started for upper subordinates to teach them such subjects as accounts and surveying, as well as the rudiments of horticulture and arboriculture. The officers of the provincial service might be trained by short periods of deputation to the Roorkee surveying and engineering classes to and the Saharanpur gardeners class and also by attaching them for a short time to the offices of District Engineers, the remaining part of their training being purely practical.

29. At the present time, excluding the newly-formed Etawah division, the establishment at the disposal of the Afforestation officer consists of two Extra-Assistant Conservators of Forests and a few men of the forester class who are being trained. One of the provincial officers is in charge of the Hamirpur sub-division and has under his control less than 7,000 acres, while the other, in charge of the Orai sub-division, has only 1,500 acres in the Jalaun and Cawnpore districts. It is self-evident that both of these officers with the assistance of trained subordinates can control a very much larger area and therefore blocks for future reclamation should, if possible, be selected within reasonable distance of the blocks already under their control, so that, when it becomes necessary to start famine work or if the landholders of these blocks can be induced to undertake the work or to co-operate with Government, these officers will be able to supervise the work in the land reclaimed by these means. But, in a subsequent paragraph, the writers have given their reason for considering it most important that certain forest reserves along the Dhasan river should be transferred from the Jhansi division to the Afforestation division and think that another provincial officer will be required to control these as well as any reclamation work undertaken in the Mau and Garotha tahsils by means of famine labour or by co-operation with the zamindars. With a view to filling this post and to the relief of the present officers who may wish from time to time to proceed on leave, and to ensuring against emergencies and possible extension in other districts, the writers strongly recommend that at least two and preferably three such officers should be immediately recruited and trained. As regards the men of the upper subordinate class, eight could now be employed in the Etawah and Afforestation divisions, although some of the charges would be small. The writers think that right men should be trained at once

and that, for the next few years, four should be trained annually. The writers recommend an incremental scale of pay rather than grade pay for each class of officer.

30. Having discussed the general possibilities of schemes for the reclamation of ravines, and the opinion of landholders on the subject, the various ways of carrying out such schemes and the establishment which would be necessary, it only remains for the writers to make definite recommendations (1) as to what blocks of ravines appear most suitable for reclamation, whenever Government is prepared to extend operations, and (2) as to what steps should be taken by Government in the immediate future.

31. In an appendix the writers have given a description of the blocks in each district, in which they think that operations should first be started. In selecting these blocks they have taken into consideration the following main points:—

- (1) The proximity of areas already undergoing reclamation.
- (2) The necessity of increasing existing blocks up to areas of economic size.
- (3) The suitability of the blocks for famine relief works.
- (4) Accessibility of the blocks.
- (5) The sentiments of the landholders concerned.

Further information as to these blocks, as well as of their adjoining and intervening blocks, which might subsequently be included in the general scheme of reclamation, will be found in Mr. Fremantle's notes on the 265 villages which he visited, copies of which have been filed in the offices of the Director of Land Records and Agriculture and the Afforestation Officer, and maps of the districts, with these village areas as far as possible roughly grouped into blocks, have been filed in the Afforestation office.

32. No blocks in the Agra district have been included, as Mr. Courthope has already submitted a separate report for the Bhadawar Estate and, as regards famine relief works, it is understood that the officers of the Irrigation department are making a report. As already indicated in paragraph 13, Mr. Courthope does not consider the few scattered blocks of ravines found in the Muttra district suitable for reclamation. There is a small area, about 80 acres near Baldeo, which it is believed the Collector of the district wishes to have reclaimed as a demonstration area and on which Mr. Courthope has written a note which the Collector has forwarded to the Commissioner. There is a large area of grass land in the Muttra district situated most suitably for the establishment of really valuable fuel and fodder reserves, but with such land this report has no concern.

33. With regard to the steps to be taken by Government in the immediate future the following are the writers' recommendations :—

- (1) In their opinion the first and most important step is the recruitment and training of a sufficient number of subordinate officers and they go so far as to say that, until the staff has been thus strengthened, reclamation work can be undertaken in no ravines other than those already under the control of the Afforestation officers.
- (2) The writers recommend that Government should instruct District Officers to ascertain definitely the willingness or otherwise of the landholders in the blocks recommended for reclamation in the appendix, (a) to reclaim and afforest their ravines at their own expense under the management of Afforestation officers, (b) to hand over their land for reclamation at the expense of Government on terms similar to those proposed to the Etawah zamindars, (c) to lease their land to Government, or (d) to sell their land. If the zamindars are willing to adopt any of these courses the writers recommend that definite arrangements should be made so that when a sufficient staff has been trained the work of reclamation can begin without delay. If there is any landholder with whom no settlement can be effected, the writers think that, in view of the importance of the objects to be attained, Government should acquire the land.
- (3) The writers would like to recommend the immediate transfer of the forest reserves along the Dhasan river to the Afforestation division, because, situated as they are at various points along the river, they are particularly well-adapted for demonstrating to the zamindars the possibilities of ravine-reclamation, while in their present state they constitute an excuse for zamindars for refraining from participation in any schemes on the ground that Government is doing nothing to improve the land which it already controls. But they are convinced that it is not possible to manage these areas satisfactorily until the establishment has been strengthened. They recommend therefore that these blocks should be transferred as soon as a sufficient staff of upper subordinates has been trained.

A. W. FREMANTLE.

E. A. COURTHOPE.

APPENDIX.**Block I.—Garotha Block.**

Situation.—The block selected is situated on the Lakheri *nala*, a tributary of the Dhasan river in the Garotha tahsil of the Jhansi district, within two miles of the metalled Garotha-Punch road, about 25 miles from Punch station.

Area.—The block includes land belonging to eight villages as follows :—

Tola	... 200 acres.	Garotha Khas	... 500 acres.
Birona	... 400 „	Garotha Khurd	... 400 „
Bangra	... 1,200 „	Garotha Rund	... 350 „
Gohana	... 800 „	Balwantpura	... 1,000 „
Total area	... 4,850 „		

Ownership.—Two Marwaris, residents of Jhansi and Garotha, hold large shares in five villages, while the remaining shares of these five villages and the whole of the other three are held by many pattidars, chiefly Ahirs, Lodhis, and Brahmans, only one eight-anna share in one village being held by Thakurs.

Reasons for selection.—This block will provide work in times of famine for the northern part of the Garotha tahsil. It is believed that another block has been selected for this purpose by the officers of the Irrigation department, but Mr. Fremantle considers that, although this block is more suitable from the point of view of famine work only, the block which he has selected will prevent erosion over a much larger area of cultivated ground. It is close to an existing forest reserve. The writers think that it would be advisable that in this tract reclamation work should be begun in some area not belonging to members of the Thakur community, whose prejudice against any interference with their land is strong, and, in selecting this block, special importance has been given to this point.

NOTE.—The block being situated so far from the railway, reclamation of this area must be considered as protective and not remunerative.

Block II.—Gursarai Block.

Situation.—The block selected is situated on the right bank of the Betwa river in the Garotha tahsil of the Jhansi district about eight miles east of Erach, and about 12 to 14 miles from the Ait and Punch stations.

Area.—The block includes land belonging to seven villages as follows:—

Gokul	... 500 acres.	Kundri	... 1,200 acres.
Dunri	... 1,400 „	Maleta	... 1,800 „
Janjaria (deserted)	750 „	Gothi	... 700 „
Shahpura	... 500 „		
Total area		...	... 6,850 acres.

Ownership.—These villages are part of the Gursarai Jagir and are held under the Jagirdar by a large number of pattidars, chiefly Ahirs, Brahmans and Thakurs, whose rights in the ravine tracts are uncertain. The Jagirdar expressed his willingness that Government should assume management of some part of the land on some such terms as those arranged with the Etawah landholders.

Reasons for selection.—This is the centre of a large tract of ravines and waste land and would form a valuable fodder reserve in times of famine, while it is not so far from the railway as to prevent it being managed as a remunerative area. It is within manageable distance of the existing forest reserves on the Dhasan river and is suitable as a famine relief work for the western part of the Garohta tahsil.

Block III.—Paricha Block.

Situation.—The block selected is situated on the left bank of the Betwa river in the Moth tahsil of the Jhansi district four miles from the Jhansi-Cawnpore metalled road, seven miles from Moth station.

Area.—The block includes land from six villages as follows:—

Rarua (deserted)	... 800 acres.	Saran	... 500 acres.
Paricha	... 1,200 „	Saina	... 100 „
Silari	... 600 „	Arora (deserted)	... 200 „
Total area, 3,400 acres, of which 330 is already reserved forest controlled by the District Officer.			

Ownership.—The villages are owned by a considerable number of pattidars, chiefly Ahirs.

Reasons for selection.—No other large block of ravines suitable for reclamation or for famine relief work can be found in this part of the district. As the incidence of grazing in this part is less than elsewhere, less hardship would be entailed in establishing a fuel and fodder reserve and in carrying out operations necessary for preventing further erosion. This block has also been selected by officers of the Irrigation department as a suitable area for a famine work.

Reclamation in this area could be carried out as a remunerative scheme, and could be supervised by the officer in charge of the Orai sub-division or the proposed Dhasan sub-division.

Block IV.—Chirgaon Block.

Situation.—The block selected is situated in the Moth tahsil of the Jhansi district on the left bank of the Betwa river, four miles from Chirgaon station.

Area.—The block includes land from the following villages:—

Bharatpura	... 400 acres.	Sikri	... 350 acres.
Dhamna	... 50 „	Aupara	... 1,000 „
Bijta (deserted)	... 275 „	Ghasgaon	... 50 „
Total area, 2,125 acres, of which 525 acres are reserved forest controlled by the District Officer.			

Ownership.—In two villages a Brahman resident in Gwalior, and in four villages two residents of Chirgaon have large shares, the remainder being held by a small number of pattidars, chiefly Ahirs and Lodhis.

Reasons for selection.—The block is suitable for a famine relief work for the south of Moth tahsil, and being situated close to the railway would form a valuable fuel and fodder reserve and, as in the case of Paricha block, could be managed by the officer in charge of the Orai sub-division or the proposed Dhasan sub-division.

Block V.—Khandaut Block.

Situation.—The block selected is situated in the sparsely inhabited tract of country in the Jalalpur pargana of the Rath tahsil of the Hamirpur district, on the right bank of the Betwa river, about 12 miles from Kalpi railway station.

Area.—The block includes lands from three villages as follows:—

				Acres.
Khandaut	...	...	...	3,500
Khadaura	...	...	...	300
Harsunri	...	...	...	500
Total area				4,300

Ownership.—Khandaut is owned by three Muhammadan co-sharers, and the other two villages by two residents of Jalalpur.

Reasons for selection.—The landholders of Khandaut have intimated their willingness to hand over their ravine land for management by Government on some such

terms as those proposed for the Etawah zamindars, and, of the other two landholders, one is anxious, and the other would probably be willing, to sell the land.

The block is situated about 10 miles from the land recently acquired for babul plantation work at Bandhar Buzurg, and the tract of almost deserted country north of the road between the two places might later on be acquired by Government as some of the landholders are anxious to sell the land. The block is situated at the end of the Jalalpur distributary of the Dhasan canal : it could be managed as a remunerative area. The block is suitable for a famine relief work for the north of the Rath tahsil.

Block VI.—Muskara Block.

Situation.—The block selected is situated on the right bank of the Barma river in the Maudaha tahsil of the Hamirpur district, two miles from Muskara.

Area.—The block selected includes land from the following villages :—

	Acres.		Acres.
Mihauna ...	400	Seoni (deserted)	2,500
Muskara ...	250	Nauranga („)	300
Bihuni Kalan ...	1,000	Chilheta Rath („)	300
„ Khurd ...	500	Chaundaura („)	700

Total area, 5,950 acres, of which 3,800 acres are deserted.

Ownership.—The landholder of Bihuni Kalan village is a resident in Jalalpur and is anxious to sell his land. Mr. Fremantle was not able to get into touch with the other landholders, but, in view of the amount of deserted land, he thinks that it is probable that they would be willing to sell their land or to co-operate with Government in some scheme of reclamation.

Reasons for selection.—The area is only eight miles from the newly-acquired Bandhar Buzurg plantation which the writers think should be enlarged. It is close to a good road and also to the proposed extension of the Cawnpore-Banda line (Sumerpur-Harpalpur branch), and although it is at present too far from a railway line to be managed as a remunerative work, it would be advisable to obtain control of the land in anticipation of the new line being constructed, more specially as so much of the land is deserted. In times of famine it would provide a relief work for the eastern part of the Maudaha tahsil.

Block VII.—Seonri Block.

Situation.—The block selected is situated on the right bank of the Dhasan river in Panwari-Jaitpur pargana of the Kulpahar tahsil in the Hamirpur district, 20 miles from Harpalpur station.

Area.—The block selected includes land from nine villages as follows:—

	Acres.		Acres.
Maleta ...	300	Gohani Panwari ...	300
Kachaucha ...	500	Sakranda Rath ...	150
Gugarwala ..	600	Salaya Khas ...	100
Ajit (deserted) ...	150	Jhannabira ...	800
		Seonri ...	1,500

Total area, 4,400 acres.

Ownership.—Three villages are held by Lalas of Banda, three by Parihar Thakurs, one by a widow of Basela, and only two by a large number of pattidars.

Reasons for selection.—The area is opposite the Motikatra forest reserve on the left bank of the river in the Jhansi district and is close to the Islampur distributary of the Dhasan canal, from which waste water should be available. The reclamation of this block would prevent a large amount of erosion as its frontage is about seven miles.

It would provide famine relief work for the western part of the Kulpahar tahsil. It was one of the blocks proposed for reclamation by Mr. Stevenson, I.C.S., lately Collector of Hamirpur, but it is an area in which work must be looked upon as protective only.

Block VIII.—Sikri Block.

Situation.—The block selected is situated on the left bank of the Betwa river in the Orai tahsil of the Jalaun district, about 10 miles from Ait and Orai railway stations.

Area.—The block includes land from four villages as follows:—

	Acres.		Acres.
Sikri ...	1,700	Kamtha ...	1,500
Kahta ...	1,100	Makrecha ...	400
Total area ...		4,700	

Ownership.—These villages are owned by a number of resident pattidars, chiefly Thakurs, Brahmans and Lodhis.

Reasons for selection.—The areas is opposite the junction of the Dhasan and Betwa rivers, close to which the existing Thorro and Burmain forest reserves are situated. It is within a mile of the Hamirpur branch of the Betwa canal from which waste water should be available. It

would provide famine relief work for the south-western portion of the Orai tahsil with headquarters at Kotra, and, being only four miles from the Kotra-Orai road, would be a remunerative block.

Block IX.—Tikar Block.

Situation.—The block selected is situated on the left bank of the Betwa river in the Orai tahsil of the Jalaun district, about eight miles from Orai.

Area.—The block includes land from three villages as follows :—

	Acres.		Acres.
Rampura ...	300	Dhanupura (deserted) ...	500
Tikar ...	2,000	Airi ...	300
Bindhauli ...	1,200		
Total area ...	4,300		

Ownership.—Four villages are owned by a small number of pattidars, chiefly Lodhis and Brahmans, the remaining one by a resident of *Kisaulia*.

Reasons for selection.—The chief reason for the selection of this block is that the 13-annas proprietor of Tikar village has expressed his willingness that Government should take over part of his ravines on the Etawah system, while there is a further large area in the deserted village. The 1,200 acres included from the Bindhauli village is only about a quarter of the whole of this village's tract of ravines. Of the remaining villages one consists of one house only. The block is within a mile of the Hamirpur branch of the Betwa canal and would provide famine relief work for the southern portion of the Orai tahsil with headquarters at Air Khas. Being situated so close to Orai it would be a remunerative block.

Block X.—Kalpi Block.

Situation.—This block is situated between the existing Kalpi Babul Reserve and the river.

Area.—The block includes land from three villages as follows :—

Dhaman ...	1,500 acres	Hamidpur ...	200 acres.
Rar ...	300 "		
Total area ...	2,000 "		

Ownership.—Twelve annas share of the village of Dhaman is held by four Ahir pattidars; the balance of the village and the whole of the two smaller villages are held by Brahmans of Kalpi.

Reasons for selection.—The existing area of reserve is about 1,500 acres. The addition of the area would bring it up to 3,500 acres, which is large enough to form a block of economical size. The holder of the eight-anna share of Dhaman seems not unwilling for some of his ravine land to be managed by Government.

APPENDIX IX.

A report on the ravines of the Bhadawar Estate (1915), Agra district, by E. A. COURTHOPE, Esq., I.F.S.

1. The investigation, of which the following is a report, has been made in compliance with instructions received in a demi-official letter no. 132, dated the 19th August, 1914, from the Under Secretary to Government. In view of the recent orders to Mr. A. W. Fremantle and myself to take into consideration the question of providing work for famine labourers, I arranged with the Superintending Engineer, 3rd circle, who had also received orders to report on the suitability of ravine reclamation for famine works, that Mr. Roche, Executive Engineer, lower division, Agra canal, should make his investigation simultaneously.

2. The whole of the Bhadawar estate is situated in the Bah tahsil, between the Jumna and Chambal rivers in that corner of the Agra district which adjoins the Etawah district. I believe that the estate owns entirely or in part 29 villages, but this report is only concerned with those in which there is ravine land. There are 19 of these and the total area of the ravine tracts is 12,859 acres, according to the list supplied to me by the tahsildar of Bah, which is attached to this report. This ravine land does not form one compact block, but the different tracts are within a reasonably short distance of each other.

3. It is necessary to give a detailed description of these ravines; while the ravines in some villages are more rugged than in others, and the "bottoms" of some ravines are wider than those of others, the ravine tract of this part of the Agra district, taken as a whole, is very much the same as the larger tract in the Etawah district. At the tops of some of the ravines there are a few fields which have been reclaimed by means of field "*bandhis*" but in this respect the villagers of the Agra district seem to be less enterprising than those of the Etawah district.

4. There can be no doubt at all that the ravines of the Bah tahsil, as in the Etawah district, are rapidly cutting back into the cultivation; at the tops of all those ravines, which begin with a sheer drop, can be seen great blocks of earth which have fallen in quite recently and which next rains will be washed away altogether. It is easy to find old inhabitants who can remember the time when ground now scored by ravines was under cultivation. At one village we saw a place where a *bandh* had been made at the head of a ravine some years ago in order to form a small tank.

From the trees now growing there it was possible to see what the level of the tank had been. From want of attention the *bandh* had been breached with the result that the bed of the ravine had scoured out to a depth of fully 20', while the head of the ravine was each year creeping farther back into the fields. From enquiries and from observations Mr. Roche and I are agreed that the average annual encroachment of those ravines is about 15'.

5. In this connection some apparently grotesque statistics are not without interest as helping to illustrate the enormous wastage of good soil that is resulting from the erosion in ravine tracts. In the Etawah district there is good evidence that 400 years ago the land, now intersected by innumerable ravines was level ground. A rough calculation shows that, at a *minimum* estimate, during this period about 150,000,000 cubic feet of earth have been washed away. This means that for every second of the 400 years 11 cubic feet have been washed out of the Etawah district in canal phraseology 11 cusecs. Although, as I have mentioned, the above is a minimum estimate, the result will appear to be sufficiently appalling if the figure is put at 5' cusecs, if it is realized that there has been a constant outflow of earth in a stream 24' wide and 2' deep flowing at the rate of one mile in three hours, which is about the rate of an ordinary canal distributary, for the last 400 years. Another way of illustrating the loss may be found in dividing the total area of the ravine tracts in each district by the period of 400 years. Thus it will be found that in the Etawah district there has been a loss of 250 acres per annum, while in the Bah-tahsil about 160 acres appears to have disappeared each year. If we put this figure at only 100 acres per annum the loss would seem to be sufficiently serious.

6. As being useful for the purpose of estimating the number of labourers for whom work could be found in times of famine as well as for the purpose of estimating the cost of reclaiming ravines, I suggested to Mr. Roche that we should lay out the sites for all *bandhs* on a known area. Mr. Roche agreed that the map attached to this report shows the ravine system which we worked over in the village of Chitra. The total catchment area of this ravine system is 320 acres, and in these ravines we laid out 42 *bandhs*. The total area of ravine tract which would be reclaimed, that is excluding all present cultivation, would be 250 acres.

By taking measurements of all the sites we have calculated that the total amount of earthwork in these 42 *bandhs* would be 420,000 cubic feet. The *bandhs* vary greatly in size, one *bandh* being as much as 50,000 cubic feet. Using ordinary labour the cost would be about Rs, 1,260, using famine labour the cost would be

about Rs. 1,680. Mr. Roche and I are agreed that the area selected for this experiment was a fairly average one, being, if anything, rather more difficult than others which we inspected. In some ravines fewer *bandhs* might be necessary, but in that case they would probably be larger ones. So it may be taken that the cost of "*bandhing*" such ravine tracts, apart from the cost of other works necessary for reclamation, would be about Rs. 5 per acre. It may also be calculated that the construction of *bandhs* would keep one man and his family occupied on each acre of ravines for about a fortnight.

7. It is also useful to note that Mr. Roche and myself laid out and measured these *bandhs* aggregating 420,000 cubic feet in three days working only in the mornings for about four hours. From this it is obvious that similar projects for famine works can easily be laid out by any trained officer at very short notice, and Mr. Roche and I are agreed that only in this way can such projects be laid out. We have had a survey of the area which we dealt with made by the surveyor employed by the estate and his map is attached, but it is extremely doubtful whether works managers could, from this map, again locate the position of the *bandhs* in spite of the measurements given. Moreover, it would be an expensive business to have such surveys made over large areas. For the purpose of making estimates it would be quite sufficient to calculate the probable earth-work by the area, as already shown, and trained men should be employed to lay out *bandhs* a short time before it is decided to start work.

8. After completing this experiment Mr. Roche and I inspected the following tracts belonging to the Bhadawar estate in addition to Chitra in which we made our experiment, and in addition to certain ravines not belonging to the estate with which this report has no concern : Naugawan, Khilaoli, Shahpur Gujar, Garwar and Nandgawan. None of these areas seemed to present any special difficulties. The ravines of Nandgawan, typical of the Chambal ravines, are somewhat deeper than those of Chitra and other Jamna ravines in those parts ; on the other hand, those of Khilaoli and Shahpur Gujar would be far easier to deal with than those of Chitra, in that the slopes are not so steep and ploughs could be employed almost everywhere without any preliminary digging.

9. I have been especially instructed to report whether it would be possible to combine a scheme for the reclamation of the ravines of the Bhadawar estate with that already inaugurated for the reclamation of the Etawah ravines. I admit that, before making any investigation, I thought that this was extremely unlikely, as I thought that

the officer in charge of the Etawah division would have as much as he could conveniently manage in the Etawah district, and I did not realize how close to Etawah the Bhadawar estate was. Since Mr. Liddiard has demarcated out the ravine tracts which are to be handed over to the management of the Forest department in the Etawah district, however, it appears that the total area to be managed in that district, including the Fisher Forest, is only about 20,000 acres instead of 30,000 acres as was first estimated. Moreover, I find that Chitra Hat or Naugawan, either of which would make a convenient centre for a new range if formed, are actually closer to Etawah than either Chakarnagar or Bhareh, which are likely to be the headquarters of two of the three Etawah ranges. Therefore, so long as work in the Agra district is confined to the Bhadawar estate, and until more land comes under the management of the Etawah division in the Etawah district, I think that there is no reason why the officer in charge of that division should not supervise work in the Bhadawar estate. But it must be recognized that, as this work of reclamation extends, as it must extend in both districts, it is quite certain that eventually another division will have to be formed whether the land managed belongs to the zamindars or to Government.

10. Having dealt with that aspect of the case I now turn to a matter which is of more immediate importance to the estate itself, more especially as I understand that the Court of Wards, on behalf of the owner, would probably be willing to undertake the work without financial assistance from Government, namely, the question of the probability of the scheme proving remunerative. This work of reclaiming ravines by means of *bandhs* and afforestation is a new work and it is not possible, therefore, to point to any block of reclaimed ravines, on which plantations have been established, as a proof that the revenue directly resulting from the work done represents a fair return on the expenditure incurred. Moreover, I do not think that this is quite a fair way to examine the project, for it must be remembered that not only will the reclamation result in direct revenue from the land reclaimed, but it also prevents loss of revenue from the land now under cultivation which would inevitably be destroyed by the encroachment of the ravines. Moreover, families who on account of the destruction of their fields would emigrate to other estates in less precarious localities will find employment in the plantations or in breeding cattle on the improved pastures.

11. I think that a fair comparison may be drawn between the reclamation of these ravine tracts and reclamation of the sand dunes in the neighbourhood of Bordeaux—Les Landes in France.

It is almost inconceivable that the French Government of about 100 years ago can have hoped to establish valuable coniferous forests on those vast stretches of apparently pure silver sand, but the Government did realize that it was possible and necessary to check the encroachment of the sand on to the inland cultivation. Accordingly the French Forest department began to hold up the shifting sand by planting tufts of coarse grass and when these were buried the forest officers planted more. It is easy to imagine the despair of these officers at the apparent hopelessness of their task, but they persevered and in the end their patient efforts overcame the forces of nature. The shifting sand was fixed and they began to sow seed. On what was once a rolling waste of sand now flourish dense pine forests, in which the peasants find ample work for themselves and pasture for their cattle and behind the shelter of which they cultivate their fields in security.

The work still goes on, more and more sand is reclaimed, and it is noteworthy that here, as in other very different localities, the French Forest department is content to go preparing the ground for future afforestation for 20 or 30 years before sowing or planting any trees.

12. Similarly I do not think that it is necessary for Government or for an estate to look too closely into the financial possibilities of schemes for the reclamation of ravines in the first instance. Nevertheless figures would seem to show that the scheme for the reclamation of the ravines of the Bhadawar estate is bound to be remunerative. I understand from the Collector of Agra that the estate could probably afford to invest a sum of about Rs. 15,000 annually in this project.

I have calculated that with this sum of money it would be possible to reclaim 400 acres per annum. Of the 19 villages of the estate which comprise a total ravine area of 12,000 acres only 10, comprising a ravine tract of 8,000 acres, are the sole property of the estate and it would be better to confine work to these at first.

It would therefore take 20 years to reclaim this area. Rs. 15,000 at 4 per cent. compound interest amounts to about $4\frac{1}{2}$ lakhs after a period of 20 years.

After 20 years the 400 acres first treated would be ready for exploitation, and thereafter 400 acres would be worked annually. Putting the value of the growing stock after 20 years at only Rs. 100 per annum, the revenue resulting from fellings alone should be worth Rs. 40,000 per annum, which is, I think, a very fair return on the capital expenditure. But this has made no allowance for revenue from grazing, from cut grass or from thinnings, and yet it is

from these sources that we mainly rely on getting early returns. In the Kalpi plantation in the dry year 1913 we obtained a crop of over 10,000 maunds of hay from an area of 1,000 acres. This year after heavy rains we have obtained crop of about 12,000 maunds from an area of 860 acres. Even assuming that there may be no sale for hay from the ravines of the Bhadawar estate in a good year,—and I do not admit that this is likely to be the case,—the sale for hay in a bad year would quite compensate for the lack of revenue from this source in a good year. The price for hay in cities such as Agra or Etawah in an ordinary year is about Re. 1 per maund, while in a bad year it is Rs. 2 or more. This is for the feed of horses. In a bad year at least Re. 1 per maund can be obtained in the district for the feed of cattle. Such years of scarcity may, I think, be reckoned to come once in every five years.

Assuming that only half the reclaimed area was kept closed during the monsoon to allow the grass to grow, the revenue from the total reclaimed area would be Rs. 5 per acre, or say Rs. 4 profit, which gives a return of about 13 annas per acre per annum.

As regards grazing under the scheme for the Etawah ravines grazing dues can only be charged for grazing on improved areas. If the estate worked on similar lines and did not charge grazing dues from the beginning, revenue from this source would not begin to come in for three years, after which time 400 acres would be ready. Thereafter the area open to grazing would increase by 400 acres each year. Re. 1 per cow or bullock is a fair fee, although graziers are willing to pay more for good grazing. Under proper management it should be possible to accommodate one head per acre, without causing deterioration to the pasture. Assuming that there is a sufficient demand for grazing, revenue from this source, starting from Rs. 400 per annum after the third year of management, should be Rs. 8,000 per annum after the 23rd year of management.

13. I have attached to this report a financial forecast based on the figures given in the last paragraph. That is, I have assumed that a sum of Rs. 15,000 is spent each year, that for the first three years there is no revenue at all, but that after the third year a revenue from grazing increasing each year by Rs. 400, that every five years with unfailing regularity there is a year of scarcity in which the reclaimed area, and the reclaimed area only, produces a crop of grass worth Rs. 8 per acre, and I have assumed that only half the reclaimed area has been closed to grazing during the rains and, finally, that, in the 20th year, the compartment sown up in the first year is felled and the produce sold at the rate of Rs. 100 per acre.

I have assumed that all the money spent is borrowed at 4 per cent. compound interest; on the other hand I have put all revenue into a sinking fund at 4 per cent. compound interest.

It will be seen that it is not until the 21st year of management is there a regular surplus of revenue over expenditure. It will also be seen that in the 30th year of management the sinking fund will be sufficient to pay off the accumulated debt, leaving the estate with its ravines reclaimed and a valuable forest established thereon from which a regular revenue of about Rs. 40,000 may be expected.

It is not, of course, to be expected that the revenue and expenditure will actually correspond to the figure given for each year. But I do not think that the forecast as a whole is unduly optimistic. It would not be unreasonable, for instance, to expect some revenue from the sale of grass every year. It is quite possible that a little revenue may be obtained from the sale of trees already growing on the ravines. There is one factor, however, which may entirely upset the forecast, and that is the question of supply of labour. The forecast is based on the assumption that an area of 400 acres per annum is reclaimed. Although the estate can, apparently, find the money necessary for this, it is possible that in good years, when the villagers are fully occupied in their fields, labour may be so scarce that it will be impossible to reclaim so large an area, in which case the whole programme would be delayed. On the other hand, it is quite certain that in years of scarcity or famine sufficient labour could be found to reclaim a very much larger area and in the interests of the villagers it would almost certainly be necessary to carry out the work on a much larger scale than usual. It is possible, therefore, that the average area reclaimed annually will be much larger than 400 acres, and in that case the financial success of the scheme would be even better than shown in the forecast. I do not know whether the estate would be in a position to find the extra money required for carrying out extra work in years of scarcity, although I suppose that Government would be ready to assist it, but I think that in any case it would be a satisfactory arrangement if the estate could put aside any savings effected in any year to form an emergency fund for years in which more money was required.

14. The Bhadawar estate is situated in a more than usually favourable position for the establishment of fuel and fodder reserves in ravine tracts, for there is a metalled road from Naugawan and Chitra to the railway, eight miles away, at Jaswantnagar on the East Indian Railway. All the villages are within quite reasonable distance of this metalled road and some of them are less than eight miles from

the railway line. There should, therefore, be a ready sale for babul bark for Cawnpore, and of fuel and grass and timber for Agra. I am informed also that transport by water is possible.

15. I find that the Collector of Agra is anxious that work on these ravines should start as soon as possible, while the Assistant Manager to the Court of Wards is anxious that it should start immediately in order to provide work for needy tenants. I can see no reason why work should not be started at Chitra at once; the position of all the *bandhs* has been marked on the ground and some of these at least could be constructed at once under the supervision of the Assistant Manager. The officer in charge of the Etawah division and perhaps the Ranger in charge of the Etawah Range might occasionally visit the estate to assist the Assistant Manager. When the *bandhs* have been constructed it will be necessary to break down the worst of the cliffs and to plough up as much ground as possible, before and during the monsoon. It will not be possible to do much actual afforestation this year owing to want of establishment, but in any case the ground would have to be prepared first in the manner suggested, and the sooner this is done the better.

16. Ultimately the following establishment is likely to be required :—

1 Supervisor on pay and allowances of about Rs. 100 per mensem.

2 Assistants on about Rs. 15 to Rs. 20 per mensem.

10 Patrols on average pay of Rs. 10 per mensem.

The estate would have to find quarters for the supervisor and his assistants, and the patrols would find quarters in the villages.

17. I think that it would be advisable that the estate should make application under section 38 of the Forest Act, so that the provisions of the Forest Act may be applied, but as the estate is likely to find all the money necessary for the project, the terms of management would be somewhat different to those drawn up for the Etawah zamindars.

In conclusion, I will only say that I think that this is a scheme which is likely to commend itself to Government in that it is one which not only calls for no further expenditure on its part, but also finds for it a sharer—if only to a very small extent—in the expense of maintaining the Etawah division.

E. A. COURTHOPE,
Deputy Conservator of Forests,
Afforestation division.

Statement no. I showing expenditure accumulated for 30 years.

Year.	Expenditure.	Interest on capital at 4 per cent	Total expenditure for year.	Accumulated capital.	Accumulated revenue as per statement no. II.
	Rs.	Rs.	Rs.	Rs.	Rs.
1st ...	15,000	...	15,000	15,000	..
2nd ...	15,000	600	15,600	30,600	...
3rd ...	15,000	1,224	16,224	46,824	...
4th ...	15,000	1,872	16,872	63,696	400
5th ...	15,000	2,548	17,548	81,244	4,416
6th ...	15,000	3,249	18,249	99,493	6,792
7th ...	15,000	3,979	18,979	1,18,472	7,623
8th ...	15,000	4,738	19,738	1,38,210	9,927
9th ...	15,000	5,528	20,528	1,58,738	12,723
10th ...	15,000	6,349	21,349	1,80,087	27,231
11th ...	15,000	7,203	22,203	2,02,290	31,520
12th ...	15,000	8,091	23,091	2,25,381	36,380
13th ...	15,000	9,015	24,015	2,49,396	41,835
14th ...	15,000	9,975	24,975	2,74,371	47,908
15th ...	15,000	10,974	25,974	3,00,345	73,824
16th ...	15,000	12,013	27,013	3,27,358	81,976
17th ...	15,000	13,094	28,094	3,57,452	90,855
18th ...	15,000	14,298	29,298	3,86,750	1,00,489

Statement no. I showing expenditure accumulated for 30 years - (concluded)

Year.		Expendi- ture.	Interest on capital at 4 per cent.	Total ex- penditure for year.	Accumula- ted capital.	Accumu- lated revenue as per statement no. II.
		Rs.	Rs.	Rs.	Rs.	Rs
19th ...	...	15,000	15,470	30,470	4,17,220	1,10,908
20th ...	...	15,000	16,668	31,688	4,48,908	1,49,344
21st ...	...	15,000	17,956	32,958	4,81,864	2,02,517
22nd...	...	15,000	19,274	34,274	5,16,138	2,58,217
23rd ...	...	15,000	20,645	35,645	5,51,783	3,16,545
24th ...	...	15,000	22,071	37,071	5,88,854	3,77,208
25th ...	...	15,000	23,554	38,554	6,27,408	4,72,294
26th ...	...	15,000	25,096	40,096	6,67,594	5,39,185
27th ...	...	15,000	26,700	41,700	7,09,204	6,08,752
28th ...	...	15,000	28,368	43,368	7,52,568	6,81,102
29th ...	..	15,000	30,102	45,102	7,97,670	7,56,346
30th ...	...	15,000	31,906	46,906	8,44,576	8,66,599

Statement no. II showing revenue accumulated for 30 years.

Years.	Sources of revenue.				Total revenue for year.	Accumulated revenue.	Accumulated expenditure.
	Grazing.	Grass in famine years.	From fellings.	Interest on accum- ulated revenue.			
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1st ...	...	...	...	...	...	...	15,000
2nd ...	...	...	...	...	...	...	30,600
3rd ...	...	...	...	...	...	...	46,824
4th ...	400	...	...	...	400	400	63,696
5th ...	800	3,200	...	16	4,016	4,416	81,244
6th ...	1,200	...	...	176	1,276	5,792	99,493
7th ...	1,600	...	...	231	1,831	7,623	1,18,472
8th ...	2,000	...	...	304	2,304	9,927	1,38,210
9th ...	2,400	...	...	396	2,796	12,723	1,58,738
10th ...	2,800	11,200	...	508	14,508	27,231	1,80,087
11th ...	3,200	...	...	1,089	4,289	31,520	2,02,290
12th ...	3,600	...	...	1,260	4,860	36,380	2,25,381
13th ...	4,000	...	...	1,455	5,455	41,835	2,49,346
14th ...	4,400	...	...	1,673	6,073	47,908	2,74,371
15th ...	4,800	19,200	...	1,916	25,916	73,824	3,00,345
16th ...	5,200	...	...	2,952	8,152	81,976	3,27,358
17th ...	5,600	...	...	3,279	8,879	90,855	3,57,452
18th ...	6,000	...	...	3,634	9,634	1,00,489	3,86,750

Statement no. II revenue accumulated for 30 years—(concluded).

Years.	Sources of revenue.				Total revenue for year.	Accumulated revenue.	Accumulated expenditure.
	Grazing.	Grass in famine years.	From fellings.	Interest on accumulated revenue.			
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
19th ...	6,400	...	...	4,019	10,419	1,10,908	4,17,220
20th ...	6,800	27,200	...	4,436	38,436	1,49,344	4,48,908
21st ..	7,200	...	40,000	5,973	53,173	2,02,517	4,81,864
22nd ...	7,600	...	40,000	8,100	55,700	2,58,217	5,16,138
23rd ...	8,000	...	40,000	10,328	58,328	3,16,545	5,51,783
24th ...	8,000	...	40,000	12,661	60,661	3,77,206	5,88,854
25th ...	8,000	32,000	40,000	15,088	95,088	4,72,294	6,27,408
26th ...	8,000	...	40,000	18,891	66,891	5,39,185	6,67,504
27th ...	8,000	...	40,000	21,561	69,567	6,08,752	7,09,204
28th ...	8,000	..	40,000	24,350	72,350	6,81,102	7,52,568
29th ...	8,000	...	40,000	27,244	75,244	7,56,346	7,97,670
30th ...	8,000	...	40,000	30,253	1,10,253	8,66,599	8,44,576

List showing area of ravines in Court of Wards villages of the Bhadawar Estate.

Village.				Area in acres.			
1.	Bhadera	...	...	...	...	455	
2.	Chitra	...	...	...	...	428	
3.	Daipura	...	...	...	...	156	
4.	Garhi Beroli	...	...	...	...	887	
5.	Garwar	...	...	...	...	1,079	
6.	Katchora	...	...	...	...	1,290	

Village.				Area in acres.
7.	Kamoni	...	...	285
8.	Khacharpura	...	...	142
9.	Khilaoli	...	...	2,438
10.	Korth	...	...	667
11.	Mao	...	...	538
12.	Nandgawan	...	...	446
13.	Naoli	...	...	215
14.	Naugawan	...	...	1,748
15.	Nonera	...	...	247
16.	Pai	...	...	627
17.	Partabpura, Garhya	...	...	191
18.	Shahpur Gujar	..	...	554
19.	Udaipur Khurd	...	...	466
Total				12,859

APPENDIX X.

Letter no. 259-L of the 6th August, 1915, from the Chief Secretary to Government, United Provinces, to the Director of Land Records and Agriculture, United Provinces.

I AM directed to acknowledge the receipt of your letter no. 1054/V—938A., dated the 26th April, 1915, with which you forwarded a copy of the report by Messrs. Fremantle and Courthope on the reclamation of ravine lands. The report, with the omission of paragraphs 2, 3 and 4, which are of no public interest, will be published in the Gazette.

2. With regard to the suggestion contained in your letter that District Boards might be empowered to acquire land with a view to reclaiming it, I am to say that the Lieutenant-Governor is of opinion that at present the District Boards have their hands full, and their finances fully occupied, with roads and education and that the day has not yet come when they can be employed on the work of general agricultural development.

3. The immediate action to be taken on the report will be as follows:—

- (i) The Commissioner of Jhansi is being asked to furnish Government with his views on the specific proposals as to the blocks of land in which work may be undertaken.
- (ii) The Conservator, Eastern Circle, is being asked to instruct the officer in charge of the Afforestation division to draw up a note showing how reclamation work can be carried on by famine labour. It is proposed to incorporate this note in the Famine Code.
- (iii) Paragraphs 27-29 of the report contain certain useful suggestions as to the training of establishment for the work of reclamation. I am to ask that you will discuss these with the Conservator, Eastern Circle.

4. The report raises the whole question of the agency that should be employed in work of this nature. The Lieutenant-Governor is of opinion that it is a waste of power to use expert officers of the Forest department in ravine reclamation. The primary object of the reclamation scheme is the increase of agricultural efficiency and wealth, rather than forestry; and for this reason His Honour is inclined to the opinion that all the experiments which are being carried out at present in the ravine tracts should, in course of time, be undertaken by the Agricultural department in preference to the Forest department. This course becomes

particularly obvious when measures are adopted for preventing the spread of erosion, whether as part of or supplementary to the scheme for the employment of ravine areas. Work of this nature is clearly more in the line of the Agricultural Engineer than in that of officers of the Forest department. The Agricultural department would, on many points, require the advice and help of a forest officer; but it should not be for the forest officer to design or control the work. Sir James Meston would like, in course of time, to see a large sub-department, under the Director of Agriculture, for the profitable utilisation of waste lands with the checking of erosion as one of its incidental duties. To some extent, as in the treatment of *usar*, its work would be one of instruction and demonstration. In other cases, such as the reclamation of ravines, it may need in a large measure to be kept in the hands of the Government.

5. In time the afforestation staff may come under the Director of Agriculture as his expert assistants in this work, specially delegated from the Forest department for the purpose. For the present the Afforestation officers must push on the work in the Etawah district, but a distinct advance will be made if it is found possible to use them for training a future staff of subordinates for the ravine work.

6. I am to ask that you will consider the whole question jointly with the Conservator of Forests, Eastern Circle, and favour Government at an early date with your views. I am also to ask that you will work out detailed proposals for the pay, numbers and training of staff which would eventually be employed on this work. In their report Messrs. Courthope and Fremantle suggested that the staff should consist of 3 classes—Lower Subordinates, Upper Subordinates, and Officers of the status corresponding to the Provincial Service. This will afford a useful basis for discussion.

7. The Lieutenant-Governor is anxious that a start in the work of training should be made next cold weather. In His Honour's opinion one provincial service officer and three or four subordinates are all that will be needed to begin with.

8. The Conservator of Forests, Eastern Circle, is being supplied with a copy of this letter direct.

APPENDIX XI.

Agreement with owners of ravine waste lands.

This indenture made the day of 191 Between
the Secretary of State for India in Council hereinafter called "the
Secretary of State" of the one part and son of
 resident of in the district of

hereinafter called "the owner" of the other part AND
WHEREAS the Local Government of the United Provinces of
Agra and Oudh hereinafter called "the Local Government" have
decided to take over certain areas of land upon the application
of the owner of the areas aforesaid with a view to the preservation
formation or conservation of forests thereon AND WHEREAS
the said owner made an application on the
day of

to the said Local Govern-
ment praying that the land set forth in the schedule hereto
annexed may be taken over under the management of the Forest
department of the said Local Government for the purposes afore-
mentioned AND WHEREAS the said Secretary of State and the
said owner have agreed that the said land set forth in the schedule
hereto annexed shall be placed under the management of the said
Forest department subject to the following conditions:—

(1) That the land be gazetted as reserved forests under sections
4 and 19 of the Indian Forest Act (Act VII of 1878).

(2) That subject to the terms of the forest settlement the
Forest Officer appointed by the said Forest department in that
behalf shall have full powers of control regarding the treatment
of the land and allotment and regulation of grazing the felling of
trees and removal of all produce and shall have powers to close
such areas to grazing as he may deem fit for such period as he may
think necessary and to impose such grazing fees in such areas as
he may think fit.

(3) That any complaint against the action of the Forest depart-
ment or any dispute arising under this agreement shall be referred
to the Collector of the Etawah district. An appeal from the
decision of the Collector shall lie to the Commissioner of the
Allahabad division whose decision shall be final.

(4) That the Local Government will pay the whole expenditure
and take the whole of the receipts until it has repaid itself the
money which it has spent on the land set forth in the schedule
hereto annexed together with interest at 4 per cent.

(5) That when the Local Government has repaid itself for its
expenditure and the said interest thereon the surplus of the income

arising from the said lands over and above the said expenditure and said interest if any will be paid in each and every year to the said owner. That until the said expenditure and said interest has been paid off the said owner will receive no cash profits arising from the said lands. That such income arising as aforesaid when due will be paid to the said owner on the first day of June in each and every year during the subsistence of these presents.

(6) That the following accounts will be maintained for each estate and for the forest as a whole namely capital revenue and expenditure accounts.

(7) That on the receipt side of the revenue and expenditure account will be credited all cash receipts of every description on the expenditure or debt side of the revenue and expenditure accounts will be entered all cash expenditure of every description including Government revenue that is now assessed or may be in future assessed on the area or the portion of the said area set forth in the schedule hereto annexed and both recurring and non-recurring expenditure and also one-fourth of the assumed pay of all officers of a superior grade whether gazetted or non-gazetted and one-sixteenth of the pay of inferior servants on all establishment bills to cover the cost of leave and pension for the staff and such sum as the Local Government may fix from time to time on the gross income to cover the cost of superior supervision.

The said owner shall have no voice in the decision of the amount of the expenditure which the Forest department may consider necessary.

(8) That at the close of every financial year the revenue and expenditure account will be totalled and the deficit or profit shall be carried to the capital account.

(9) That for several years the expenditure will exceed the receipts and the excess will be carried to the debit of the capital account. At the end of the financial year interest at 4 per cent. shall be added to the total sum on the debit side of the capital account and such interest shall be calculated on the mean between the outstanding balance at the commencement and the outstanding balance at the close of each financial year.

(10) That when the revenue and expenditure account shows a profit it shall be carried to the credit of the capital account and deducted from the total on the debit side.

(11) That when the debit balance of the capital account has been paid off by the profits from the revenue and expenditure account any sum standing on the credit side shall be paid to the said owner on the 1st day of June in each year.

(12) That expenditure on works in each estate will be kept

separate and each estate will be debited with a share of all expenditure common to the whole range or the whole division proportionate to the acreage but no estate will be debited with any share of range or divisional expenditure until the estate has been gazetted under section 4 of the Forest Act and management assumed by the Forest department.

(13) That the profits derived from the area belonging to each separate estate will be kept separately. In the event of contracts covering two or more estates the profit and loss will be divided proportionately to area.

(14) That in the event of any dispute arising as to the revenue and expenditure account the Local Government shall appoint a chartered accountant to audit the same which audit shall be final and the fee chargeable by such chartered accountant will be debited to the said account.

(15) That the Secretary of State may at any time relinquish the said lands set forth in the schedule hereto annexed.

(16) That if the Secretary of State relinquishes the said lands the said owner shall not be liable to pay Government any amount that may be standing at the debit of the capital account.

AND IT IS HEREBY FURTHER AGREED that if any part or parts of the said land hereby taken under the management of the Forest department by these presents shall be cleared and broken up for the purposes of cultivation or any other purpose and thereby rendered liable to assessment to Government revenue under the law in force for the time being the said Local Government may assess such part or parts so broken up and brought under cultivation to Government revenue AND IT IS FURTHER AGREED AND DECLARED that out of any rents that shall accrue from lands placed under cultivation under the foregoing clause one-half of the rent accruing from the same shall be paid within days from the date of collection of the same to the owner and the other half be placed to the credit of the revenue and expenditure account AND IT IS HEREBY FURTHER AGREED that if the said owner should desire at any time to take back the land set forth in the schedule hereto annexed into his own occupation and management he shall have the option of doing so at the expiry of the period of the current or of any future settlement of the land revenue of the district in which the said land is situated upon his giving a previous 12 months' notice expiring on the 31st March in writing of his intention so to do to the said Local Government and upon his paying the balance if any due on the said capital account and upon his executing an undertaking to manage the said lands set forth in the schedule

hereto annexed in a manner to be laid down by the Local Government and such land so taken shall be subject to the payment of any Government revenue which then or may at any time thereafter be assessed upon the said land so taken back or any portion thereof AND in the event of a breach of any of the terms laid down by the Local Government for the management of the said property as aforesaid by the said owner then it shall be lawful for the said Secretary of State to re-enter into and upon the said lands set forth in the schedule hereto annexed and occupy and manage the same under the conditions laid down in this agreement for as long as the said Local Government pays to him the said owner the profits payable to him under this agreement.

In witness whereof the parties hereto have set their hands the day and year first above written.

APPENDIX XII.

Note on the possibilities of afforestation in the ravines on the edge of the Ganges Khadir, Meerut district, by E. Benskin, Esq., I.F.S.

The ravines along the Ganges in the Meerut district differ in characteristics from those of Agra and Etawah in that they generally start more gradually from the cultivation above, although there are doubtless places where ravine formation is of a more serious nature.

2. The ravines rise from the higher cultivated level and pass directly through the khola which has an undulating appearance and consists of little hillocks covered often with a very fair forest vegetation and, where this is absent, with thick coarse grasses. In the depressions between the higher level the soils is covered over with a deep deposition of sand. On the whole the country is very similar to some of the French sand dunes. From the khola the ravines disappear into the khadir which is a strip of low lying and waterlogged land covered with tall grasses, interspersed with a certain amount of crop cultivation : it is understood that this strip of country was once the bed of the Ganges.

The khola and khadir traverse the whole length of the eastern boundary of the Meerut district and have a combined average width of 1 mile.

3. Round the edge of the ravines and in the khola there is a considerable growth of trees, but I noticed that this tree growth is confined to those areas which are free from deep sand accumulation. Of the more valuable tree species found on the area shisham seems to grow fairly well, also "*Holoptelia integrifolia*," but there was a noteworthy absence of natural regeneration due to some unknown causes. Along the outer edge of the ravines "*Butea frondosa*" appears to be the predominant species.

4. The soil, where not covered over with sand, is of a compact alluvial nature, somewhat coarser in texture to the soils usually met with in the ravines of Etawah. The water level is within a few feet of the surface over the greater part of the khola, while in the khadir water lies about the surface in pools throughout the greater part of the year.

5. There is no doubt the establishment of a forest in the khola of the Meerut district would be a most profitable undertaking owing to the proximity of the Imperial city : part of the area is already adjacent to the railway and it is understood that there are

to be further railway constructions which will completely open up the country. Even in parts some 20 miles from the market by road, there is a ready sale for fuel, and I was much surprised to hear that the Court of Wards were able to sell even their dhak forests at a good price. There is every indication that the demands for timber and fuel will become greater in the near future and, as the country is opened out, a forest estate would become a most valuable property.

6. Owing to the difference in the conditions as compared with those met with in the Etawah ravines I think it would be advisable, before giving any definite proposals, if some experiments were carried out in different localities in order to determine the most suitable species which could be introduced into the area and the best means of raising those species. I have little doubt that shisham plantations could be easily raised along the upper edge of the ravines and on the higher land within the khola: the soil conditions are most certainly far superior to those prevailing in Etawah where shisham has been so successfully raised. There are also other species which could doubtless be introduced, such as kamhar, "*Gmelina arborea*"; tendu, "*Diospyros melanoxylon*"; teak, "*Tectona grandis*"; sirsa, "*Albizia procera*;" kusam, "*Schleichera trijuga*;" all of which are known to be easily established on ravine soils.

As regards the depressions covered with a deep deposition of sand, I am doubtful whether the soil conditions are sufficiently suitable for direct afforestation, and it will probably be found that soil improvement operations will be necessary for many years before any planting or sowing operations could be successfully undertaken. Owing, however, to the proximity of water to the surface it may be possible to find species which will overcome these difficulties. I propose that experimental plots of 5—10 acres each be selected in the following positions in order to determine the best means of afforesting each class of land found within the khola, and also what operations should be undertaken to improve the condition of the soil:—

- (1) At the head of a ravine and including part of the ravine course, 10 acres.
- (2) On the higher land within the khola.
- (3) On low sandy land with a thick grass covering.
- (4) On low lying land with a moderate grass covering.

If possible, the plots should be contiguous to one another or adjacent.

The khadir or low lying land offers far greater difficulties and owing to its waterlogged nature drainage is out of the question. The

only means of afforesting this area would be to plant out on high mounds or banks such species which are known to thrive on waterlogged soils. The area is at present treeless except for a stunted growth of "Tamarix." I am informed that during the monsoon about 3 feet of water lies over the whole country. I proposed to take up an area of about 3 acres in the khadir, and I am in communication with the silviculturist for his assistance in choosing the most suitable species to experiment with.

7. It is quite impossible to prepare any detailed forecast of the financial return without any basis to work upon, so I will not attempt to do so; but if it is found possible to raise forest plantations without undue difficulty, their success is assured owing to the ideal situation with regard to the markets.

8. My proposals are to take up an area of 30 acres in various parts of the khola and khadir. In order to supervise this work it would be necessary to put a Supervisor in charge for five months in order to see that the necessary operations were carried out during the rains and also a forest guard should be appointed to assist him in carrying out the work and protecting the plantations which should be fenced either with wire or thorns.

The cost of establishment and cultural operations for one year would be as follows :—

	Rs.
1 supervisor at Rs. 20 per mensem for 5 months	... 100
1 forest guard at Rs. 8 per mensem for 12 months	... 96
Cultural operations, inclusive of all charges at Rs. 35 per acre, over 30 acres	... 1,500
Total	... 1,246

Owing to the possibility of failures during the first year it would probably be necessary to continue experiments during the next and subsequent years. It may be that no difficulties will arise, but I would strongly advise that operations should be on a small scale for at least three years until it is seen how the plantations develop.

Assuming that no unforeseen difficulties arise it would be possible to afforest the khola ravines at a cost not exceeding Rs. 35 per acre, inclusive of all charges. This expenditure at the end of 40 years at 4 per cent. would accumulate to Rs. 168 : even allowing no return in the intervening years for grazing, and from thinnings I think that there would be a possible return.

9. There is a point which has to be considered and that is the effect of an afforestation scheme on grazing. Grazing cannot be permitted in any newly raised plantations until the plants are sufficiently well established to withstand damage. No grazing

should be allowed in any sowing or plantation block for eight years. Assuming the regeneration rotation to be 40 years this would mean that not more than one-fifth of the area would be closed to grazing at any time. I do not think that this would affect the surrounding people severely.

10. It is understood that there is an estate with some considerable area of ravines in this locality under the Court of Wards and that they are desirous of undertaking afforestation operations. During my short stay in the Meerut district I was unable to see more than a trifling part of the estate, but it is believed that the above remarks and suggestions would apply equally well to this part also. The area of the ravines in this estate, so far as I can gather, are some 3,000 acres, and I understand that the estate would be prepared to pay the expenses incurred on a small experiment such as is now suggested. Work can be started immediately or as soon as is desired.

It would be desirable if the Court of Wards could give some idea as to the annual grants they would be prepared to make for the work. Assuming an area of 80 acres is taken up each year an annual grant of Rs. 2,800 would be necessary. The labour would, I think, be ample for this work, but should operations have to be curtailed on this account it would be advisable to put any savings aside for utilizing the additional labour available in years of famine. Such labour can always be employed with advantage and without affecting the general scheme in any way.

11. The final point which I wish to draw attention to is the necessity for the application under section 38 of the Indian Forest Act for the reservation of these forests, as, without this, the plantations cannot be adequately protected.

E. BENSKIN,
Divisional Forest Officer,
Afforestation division.

Dated the 7th April, 1916.

APPENDIX XIII.

Note on the financial expectations of afforestation.

As one of the principal points to be considered in dealing with the revision of the landowners' agreements at Etawah will be the financial prospects of afforestation, it would be well to calculate, as well as the limited data at present available will allow, what the financial expectations will be.

Areas may be divided into three categories :—

(1) Areas which will certainly pay handsomely. These include all areas near large towns, i.e., Fisher Forest, the Allenbagh, the Improvement Trust areas at Cawnpore and Lucknow, and the area tentatively suggested near Agra. Also areas with easy rail communications to large markets, e.g., Kalpi. It must be noted that all these areas will have a very fair *annual* revenue from fuel and grass, more than sufficient to pay all interest charges, and this is of considerable financial importance.

(2) Areas which will certainly *not* pay if considered as a purely financial proposition. These include areas on the Kuari (Bindwakhurd, Bindwakalan, etc.), a river which is dry for most of the year and practically useless for floating. Land carriage from these areas would be prohibitive.

(3) Areas where the financial expectations require to be more closely examined, and in this category are included the majority of the Etawah ravine areas, i.e., all plantations along the Jumna, Chambal ravines, from which either road transport or river transport is feasible to railways.

The following calculations are based on the following data :—

I. Expenditure—

	Rs.	a.	p.	
(1) The initial capital cost of creation of plantations (based on actuals) ...	40	0	0	per acre.
(2) Annual recurring charges of upkeep (including all establishment, etc.) ...	3	0	0	„
(3) Annual minimum payment to landowner ...	0	8	0	„
(4) At the end of every 20th year, a special expenditure in sowing and planting, filling up blanks, etc., of ...	10	0	0	„

II. *Revenue*.—Before calculating this, a brief explanation of the system of management must first be given. The system will be essentially babul coppice (on a 20-year rotation) with a sprinkling

of standards of good quality *timber* trees (especially shisham) on a 40-year rotation. The standards will be so far apart as not to interfere with the fodder crop, the extreme importance of which is fully realised, and in these ravine lands the very best and maximum yield of fodder is obtained under a crop of babul trees.

It is assumed throughout that the area to be reclaimed will be free of rights. But the revenue anticipated from fuel, fodder and grazing has been put on a very low basis, so that the local inhabitants may benefit, since the principal object of these plantations is the improvement of agricultural conditions in these precarious tracts. The revenue expected from timber and babul is conservative and *not* optimistic.

Each year 1 acre is afforested ; when 5 years old, the first thinning will be made, and 320 plants at 1 pice each obtained—Rs. 5. When 10 years old, the second thinning will be made and 160 plants at 1 anna each obtained—Rs. 10. When 15 years old the third thinning will be made, and 48 plants at 3 annas each obtained—Rs. 9. In the 20th year a final felling of the coppice will be made, giving 100 trees per acre. In these calculations, these 100 babuls have been calculated both at Re. 1 and 8 annas each nett. (The sale value in Cawnpore is about Rs. 2-8-0 each.) This completes the first rotation of the coppice, and there are left 15 timber trees as standards. Thus at the end of the 20th year there will be 20 acres in a series of age gradations with the coppice 0—19, and the standards 1—20 years old.

In the second, 20 years (i.e., 21st to 40th year), there will be a final coppice felling on 1 acre each year, and thinnings as above. In the 40th year will be in addition a final felling of standards 1 acre, giving 15 trees at Rs. 20 each. (1 tree gives 20 cubic feet in the log at Re. 1 per cubic feet.) In the third, 20 years (i.e., 41st to 60th year), the coppice revenue will be as above, and there will be a final felling of standards over 1 acre each year. The *annual* revenue from fodder and grass is calculated as follows :—

Fodder grass.—Valued at 2 annas per maund on one-quarter of the crop or 4 annas per acre in normal years. And 2 annas per maund on the full crop or Re. 1 per acre every fifth year, when fodder scarcity may be expected.

Grazing.—Four annas per acre per annum for four-fifths of the area (i.e., 16 acres open out of 20), each area being closed until it is 4 years old).

Areas will be treated as follows :—

Entirely closed for four months (June—September).

Open to grass-cutting for four months (October—January).

Open to grazing for four months (February—May), after the 4th year.

A crop of 8 maunds of hay per acre per annum is obtained after reclamation. This will only be fully utilised in scarcity years. We can now calculate the financial expectations of plantations on the data given above.

A.—On 1st rotation of 20 years.

I.—*Expenditure or capital cost.*

One acre at the age of—	Original capital cost.	Increasing by compound interest at 4 per cent.	Total cost.	Recurring annual charges upkeep at Rs. 3.	Payment to landowner at 8 annas.	Remarks.
Years.	Rs.		Rs.	Rs.	Rs.	
20	40	$\times 2.1911$	87.64	89.33	14.89	For simplicity of calculation, capital cost has been reckoned as being incurred at the beginning of each year, and recurring annual charges at the end of each year.
19	40	$\times 2.1069$	84.28	83.01	13.83	
18	40	$\times 2.0258$	81.03	76.93	12.82	
17	40	$\times 1.9479$	77.92	71.10	11.85	
16	40	$\times 1.8730$	74.92	65.46	10.91	
15	40	$\times 1.8009$	72.04	60.09	10.02	
14	40	$\times 1.7317$	69.27	55.17	9.19	
13	40	$\times 1.6651$	66.61	49.89	8.32	
12	40	$\times 1.6011$	64.04	45.09	7.51	
11	40	$\times 1.5395$	61.58	40.50	6.75	
10	40	$\times 1.4802$	59.21	36.00	6.00	
9	40	$\times 1.4233$	56.93	31.74	5.29	
8	40	$\times 1.3686$	54.75	27.63	4.60	
7	40	$\times 1.3159$	52.64	23.70	3.95	
6	40	$\times 1.2653$	50.61	19.89	3.32	

One acre at the age of—	Original capital cost.	Increasing by compound interest at 4 per cent.	Total cost.	Recurring annual charges upkeep at Rs. 3.	Payment to landowner at 8 annas.	Remarks.
Years.	Rs.		Rs.	Rs.	Rs.	
5	40	$\times 1.2167$	48.67	16.26	2.71	
4	40	$\times 1.1699$	46.80	12.75	2.12	
3	40	$\times 1.1249$	45.00	9.36	1.56	
2	40	$\times 1.0816$	43.26	6.12	1.02	
1	40	$\times 1.0400$	41.60	3.00	0.50	
Total cost of 20 acres at end of 20th year ..			1238.80	823.02	137.17	Rs. 2,199

II.—Revenue.

- (1) Annual.—*Grass* 4 annas per acre per annum, plus an extra 12 annas every fifth year, an average of 6.4 annas per acre per annum, plus compound interest at 4 per cent.

Revenue in 20 years ... $137.17 \times \frac{6.4}{8.0}$

Rs. 109.73

- Grazing*.—Four annas per acre per annum from the fifth year, plus compound interest at 4 per cent.

Revenue in 20 years ... Rs. 36.43

- (2) Periodic.—*Thinnings*—

First.—Thinnings Rs. 5 each year from 6th to 20th year, Rs. 75 plus compound interest at 4 per cent. ... 104.12

Second.—Thinnings Rs. 10 each year from 11th to 20th year, Rs. 100 or plus compound interest at 4 per cent. ... 124.86

Third thinnings Rs. 9 each year from 16th to 20th year, Rs. 45 plus compound interest at 4 per cent. ... 50.69

- (3) Final coppice felling (a) 100 trees at Re. 1 ... 100
or (b) at 8 annas ... 50

Total revenue at end of 20 years (a) 525.83 or (b) 475.83

This reduces the total capital value of 20 acres at the end of 1st coppice rotation to—

(a) Rs. 1,673 or (b) Rs. 1,723.

B.—On the 2nd rotation of 20 years.

I.—Annual expenditure—

	Rs.
(1) Special expenditure on 1 acre ...	10
(2) Upkeep charges on 20 acres ...	60
(3) Payments to landowner, 20 acres...	10
Total ...	80

II.—Annual revenue—

	(a)	or	(b)
(1) Final coppice felling on 1 acre per annum ...	100		50
(2) Thinnings on 3 acres per annum ...	24		24
(3) Grass, 6·4 annas per acre on 20 acres ...	8		8
(4) Grazing, 4 annas per acre on 16 acres ...	4		4

Total annual gross revenue ... Rs. 136 (a) or Rs. 86 (b).

Nett annual revenue. (a) Rs. 56 or (b) Rs. 6.

(NOTE.—So far we have dealt only with babul coppice, grass and grazing, and if the plantations were simple babul and grass the financial expectations would be poor, i.e., after paying the minimum of 8 annas per acre per annum to the landowner, Government would get—

(a) In the more favourably situated localities, where 20-year old babul are worth Re. 1 each, an annual return of Rs. 56 on a capital of ... Rs. 1,673=3·3 per cent.

(b) In the less favourably situated localities where 20-year babul are worth 8 annas each, an annual return of Rs. 6 on a capital of ... Rs. 1,723=0·35 per cent.

We will now go on to consider the effect of the standards of timber trees on the financial aspect.

Rs.

At the end of the 2nd rotation (i.e., in the 40th year) we get the 1st standard timber felling, or 15 trees at Rs. 20 each... =300

Thus the total capital value of 20 acres at the end of the 40th year becomes—

(a) (Rs. 1,673 × 2·1911)—Rs. 56 per annum plus compound interest)—300
= +Rs. 3,665·7—1,667·5—300
= Rs. 1,698.

(b) (Rs. 1,723 × 2·1911)—Rs. 6 per annum × compound interest)—Rs. 300
= +Rs. 3,775—177—300
= Rs. 3,298.

C.—On the 3rd rotation of 20 years.

			Rs.
I.	Annual expenditure (as above)	...	80
II.	Annual revenue—		Rs.
(1)	From babul coppice and grass and grazing		
	as above	... (a) 136	(b) 86
(2)	From timber standards, 1 acre per annum		
	(for 1st 19 years)...	... Rs. 300 for 19 years.	
	Nett annual revenue (for 1st 19 years)	... (a) 356	(b) 306
	and for 20th year...	... 56	6
	Then total capital value at end of 60th year—		
(a)	(Rs. $1,698 \times 2 \cdot 1911$)—(Rs. 356 per annum for 1st 19		
	years plus compound interest)—Rs. 56		
	= + Rs. $3,720 - 10,245 - 56$		
	= Rs. 6,581 (i.e., a <i>surplus</i> of over Rs. 6,000).		
(b)	(Rs. $3,298 \times 2 \cdot 1911$)—Rs. 306 per annum for 1st		
	year)—Rs. 6		
	= Rs. $7,226 - 8,806 - 6$		
	= Rs. 1,586 (i.e. a <i>surplus</i> of over Rs. 1,500).		

These figures conclusively prove (1) that simple babul coppice and grass-grazing will not prove financially profitable, but the grass is essential for famine insurance and to improve the general conditions for the cultivators, while the babul is very useful for reclamation, for improving the grass crop, and for giving intermediate early returns; (2) that timber standards with babul coppice and grass will prove financially profitable; (3) that Government can afford to pay the landowner a minimum of 8 annas per acre, as each acre comes under reclamation (under present agreements the landowner would get no cash return for 40-50 years) debit 4 per cent. compound interest on capital expenditure up to the 40th year, and between the 41st and 60th years will recover not only the capital invested plus compound interest, but obtain also a $\frac{3}{4}$ share of the surplus (which should be between Rs. 1,500 and 6,000 on each 20 acres), actually, results will be better than these calculations show, because it is proposed to treat a certain proportion of the whole area of each plantation (possibly 20 per cent.) for intensive *timber* production, the financial expectations from which are very much higher than scattered timber trees amongst babul coppice, and the calculations have been made throughout on the latter (and less favourable) basis. However, the figures as they stand are sufficiently satisfactory. It should be emphasised that for areas in category (1) referred to above, e.g., areas near big towns such as the Allenbagh, Fisher Forest, etc., financial expectations are naturally very

much higher, while for landlocked areas in category, (2) where excessive cost of extraction and freight will materially reduce the nett value of babul and timber, these calculations do not apply. But taking into consideration the conservative estimates and data on which these calculations are based, there can be no doubt that enormous areas of waste lands in the province will come within the radius of profitable working which these calculations indicate.

E. A. SMYTHIES,
Sylviculturist, United Provinces.

APPENDIX XIV.

RAVINE RECLAMATION AND FAMINE RELIEF.

Being a note on the experience gained in the Etawah district
in the 1919 famine.

Introduction.

1. In the autumn of 1918, when the complete failure of the monsoon had made it clear that there would be severe scarcity in the ravine tracts of the Etawah district, Government decided that the principal form of famine relief in those tracts should be ravine reclamation work. This was a form of relief that had not been tried previously to any appreciable extent, and the Famine Code, comprehensive as it is, does not in many ways cover this type of work. Moreover, few Forest Officers in these provinces know much about the Famine Code, or have had occasion in the past to study it intimately in its actual working. With the probable extension of afforestation and ravine reclamation work in the province and with the certainty of recurrence of famine operations (in the Jumna-Chambal ravine tract especially), at fairly frequent intervals, the need of some guide or record for this type of work becomes apparent. This note has, therefore, been drawn up on the experience gained in the 1918-19 famine in the Etawah district. Although primarily from the Forest point of view, and to serve as a guide to the Forest Officer, it will, it is hoped, also prove of some value to Collectors and Famine Officers within whose charge this type of famine relief work is adopted.

The absence of all previous experience of famine relief work in ravine reclamation led inevitably to a few mistakes in the beginning. The accounts procedure was new to the Forest staff, while the standardization of tasks, the organisation of gangs, the checking of continually shifting work, and many other points had to be ascertained by practical experience before the work could run smoothly and properly. This note will, it is hoped, help to smooth over the initial difficulty when ravine reclamation work is again carried out by famine labour.

Chapter I.

PRELIMINARY WORK.

2. In order to understand what follows, a brief description of objects and methods of ravine reclamation is desirable. The courses of the Jumna and Chambal rivers (and several of their

Description of
ravine tracts.

tributaries) through the plains are characterised by innumerable ravines on their banks. The banks of these rivers have for various reasons (chiefly uncontrolled heavy grazing of cattle, goats, camels, etc.) become almost destitute of vegetation, except for a sparse and desert flora. This absence of protective vegetation and the resulting rapid flow or rush of water in the monsoon from the comparatively high flat plateau to the river through the soft alluvial soil has resulted in a vast and intricate network of ravines being formed. These ravines extend for a distance varying from a few furlongs to a few miles on both sides of the Jumna and its tributaries; they often start suddenly at the edge of cultivation with a drop of some 80 feet or they may be less severe, and they take up a meandering course, joining up with other systems, eventually falling into the main river. This ravine belt is increasing in extent every year as the ravines eat into the flat cultivated lands at their heads in each monsoon. These ravine lands are at present almost valueless they yield a small quantity of inferior fuel and still more inferior grazing and that is all.

The surface is almost impermeable to rain water, and all natural reproduction and grass die down as soon as the rains cease.

The objects of reclaiming these ravines are—

**Objects of ravine
reclamation.**

- (1) to check further erosion and loss of cultivated lands at their sources;
- (2) to afforest these waste lands and obtain therefrom improved grass and fuel for the local villagers, and valuable commercial products (timber and poles, tanning bark, bamboos, etc.) to pay back the cost of reclamation;

To any who are not experienced in ravine reclamation work, the following brief description of technical treatment may be useful.

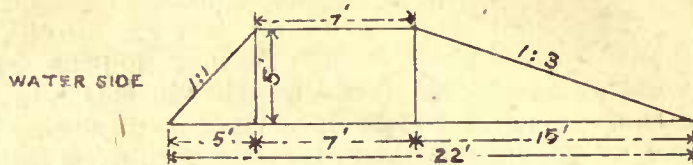
In treating this ravine country, the two great essential facts to be considered are—

**Method of ravine
reclamation**

- (1) to check the further erosion;
- (2) to improve the soil aeration and moisture content.

The erosion in the ravine beds is checked (and converted into deposition) by the formation of *bandhs* or dams across the ravines in suitable places, and the erosion on the sides and at the head of ravines is checked by creating an adequate clothing of vegetation. But the vegetation can only be produced by the improvement of the aeration and moisture content of the soil.

The method of *bandhing*, the measurements and diagram of a typical *bandh* are given below :—



Length	45'	} Cubic contents of <i>bandh</i> = 3,825 cub. ft.
Height	5'	
Top width	7'	
Slopes	1 : 1 and 1 : 3	

NOTE.—The flat top and the angles of slopes are fixed ; the height (and base) vary according to the site. The water level is fixed at two-thirds of total height and is regulated by the level of the water escape.

The laying-out and construction of *bandhs* have to be done with great care, since if one *bandh* in a ravine gives way in the rains the dammed up water suddenly released nearly always carries away all the *bandhs* below. The following are the chief points that require attention :—

- (1) *Bandhing* is started at the tops of all the side ravines and worked down to the junction with the main ravines. (The main ravines are seldom *bandhed* at all, because if the side ravines are well done, they would be unnecessary, and if badly done they would never stand the rush of water.) Every branch ravine must be *bandhed*.
- (2) In determining the site for a *bandh*, a controlling factor is the proposed position for the water escape. This must always be as far away from the *bandh* as possible. If there is a low narrow neck which can be cut through to lead the flood water to another ravine, the condition is ideal. An escape skirting the edge of a *bandh* will very soon scour out and undermine the *bandh* which will never survive. Frequently a well-planned *bandh* will have a sheet of water stretching to 100 yards on the up side in the rains.
- (3) *Bandhs* to be at right angles to the flow of water and never in a narrow gorge with steep banks.
- (4) The water escape must be capable of taking off all flood water. Its bottom level must be carefully fixed so as to be about 3' below the top of the *bandh*.

The amount of *bandhing* required varies considerably with the country, and no average can be given.

Simultaneously with this *bandhing* work the sides and heads of the ravines are prepared for tree growth.

Preparation of the flat high level land.

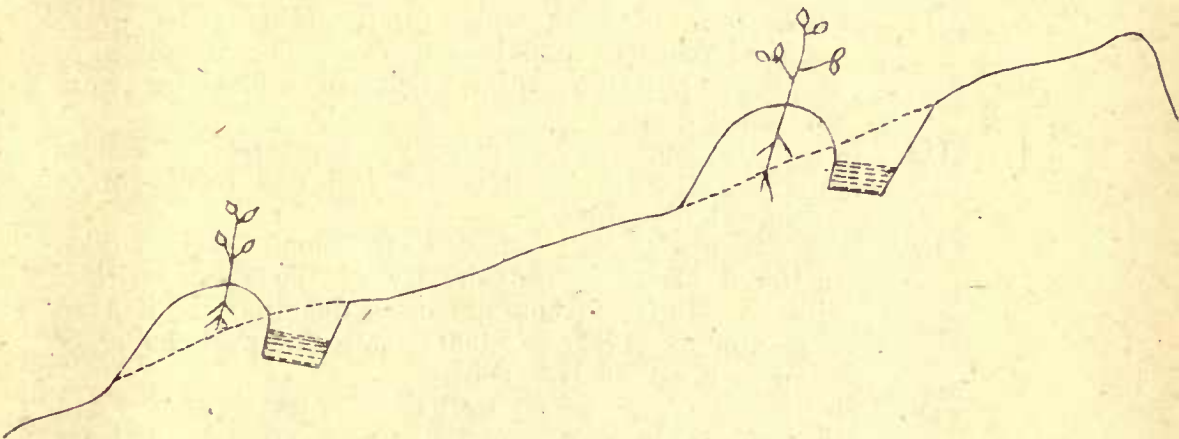
The whole surface is ploughed up deeply with English Sabul ploughs to a depth of 9" to 10" and the surface crust thoroughly broken up. In famine years this work is done by hand to create a big labour demand for the famine-stricken population, as is being done this year.

Small parallel ridges (1' high and 2' broad at the base) 10' apart are then made by hand labour usually with a shallow ditch on the upper side. These ridges act as seed beds, and the soil is kept loose and the clods well broken up, so that the rootlets can penetrate easily. The same method of preparation is employed in the ravines also, wherever the ground is at all flat or gently sloping.

Preparation of the steep slopes in the ravines.

With an almost vertical slope, little or nothing can be done, but with all slopes up to 60° shallow platforms, or ditches and ridges are made on the contour.

Section of a terraced slope.



The ditches act as silt and water traps, and the mounds as efficient seed beds. Petty irregularities in the surface are at the same time eased off as far as possible, pinnacles of earth knocked down, knife-edged ridges flattened, runnels eroded by rivulets smoothed off, and so on. All this surface working, *bandhing*, and ditching, etc., has a striking effect on the catchment of the rainfall. For whereas in untreated areas (as already mentioned) the maximum penetration is only 10", in worked areas the soil after a year shows moisture down to 3', and after two or three years when vegetation has been established the water penetration increases up to 7'. After two years, practically no water escapes the lowest *bandhs*.

This brief note will suffice to indicate the principles of working as far as famine labour would be concerned, the subsequent sowing and tending is done in the rains when famine relief work ceases.

4. There are several factors in this ravine reclamation work which make it a very suitable form of famine relief. These may be briefly indicated—

- I. The variety of work affords employment for every description of unskilled labour; for men, digging and cliff-breaking; for women, ridging and carrying earth; for the old and feeble and for quite small children, clod-breaking on the *bandhs* and ridges. (The details of organization and classification of gangs are given in the next chapter.)
- II. It is a form of work which (unlike other relief works such as roads or buildings or tanks) can be started or stopped at any time, without rendering useless the work previously done.
- III. It will in time prove directly remunerative, besides affording a permanent improved fuel and fodder-supply to the neighbourhood.
- IV. It is singularly well adapted to small civil works, scattered about in the vicinity of the famine-stricken villages. In fact, labour should be definitely limited to a maximum of 800 to 1,000 on any one work, as larger numbers are difficult to control.
- V. The gangs of 30 to 50 work more or less separately and the work is always moving on to new ground. This is a favourable factor for sanitation and prevention of cholera or other infectious diseases.
- VI. Reclamation work is peculiarly flexible and elastic, and a scheme of work prepared before the famine starts can be easily and quickly adapted or added to or altered to meet altering conditions of labour-supply.

Advantages of
ravine reclama-
tion work, for
famine relief.

5. When the monsoon failure indicates clearly that famine operations will be necessary, the Forest Officer, in consultation with the Collector, has to draw up the scheme of work to be followed, if such scheme is not already prepared. The Collector indicates roughly where relief works will be required, and how much labour at each may be expected. The areas to be worked over are then fixed, and the boundaries clearly demarcated by a *dag-bel* on the ground. It will enormously facilitate subsequent checking and control if rectangular 10 or 20-acre plots are *dag-belled* out, and numbered, two or three or five or more such plots being marked at each work as required, simultaneously the *bandhs* required in these plots have to be selected, their sites pegged and *dag-belled*, their dimensions taken and tracings prepared, and their water escapes clearly defined. This work has to be completed before the opening of any test work, which itself precedes the declaration of famine.

Preparation of
famine relief
scheme.

Chapter-II.

ORGANIZATION OF LABOUR AND TASKS.

6. Before describing the organization of labour and fixing the tasks, a brief account of what famine relief work is will help the uninitiated Forest Officer to understand what follows. It consists essentially of daily labour work on a gigantic scale.* With all sorts and conditions of labour (from stout men to infants in arms), which is all carefully graded into 5 or 6 grades, each grade has its standard daily wage. Wages are paid daily in annas and pice to every man, woman, and child on every work, after the daily tasks have been measured up. Tasks not completed to standard lead to small fines. Daily labour muster rolls are kept up by gangs and grades of labour, but no signatures or thumb-impressions taken. These details of working conditions will suffice to indicate the necessity of really good organization of labour, staff, and tasks, to avoid confusion. When it is added that there are black sheep in every fold, but famine works appear to draw more than the usual proportion, the further necessity of most elaborate check and constant supervision becomes apparent.

The essentials
of famine relief
work.

* To give an idea of scope of the work, payments in forest famine works in the Etawah district in 1918-19 exceeded Rs. 1,000 daily when the famine was in full swing, distributed between 15 works which were scattered over 50 miles of country. The famine labour or ravine reclamation under Divisional Forest Officer, Afforestation Division, amounted to more than half the total famine labour for the whole province.

Organization of
labour and staff.

7. The grades of labour. These are defined in the Famine Code. They are summarised for clearness of subsequent details—

LABOUR—

- A.—Mates of gangs.
- B.—Strong men and women.
- C.—Weak or old men and women, youths, and maidens of 15 or 16 years old.
- D.—Children 10—14 years of age.
- G.—Children 7—10 years of age.
- H.—Infants in arms.

STAFF—

Foremen.—One foreman to 150 labour.

Managers.—One to each work.

Circle Officers (i.e., Range Officers).—

5-6 works and 3,000 to 5,000 units of labour is as much as one Range Officer can adequately look after. He must see each work once a week. The Divisional Forest Officers from 12 to 20 works, 10,000 to 15,000 units of labour is as much as the Divisional Forest Officers can control. He should see each work once a month.

The labour that comes to the work is classified and divided into gangs. Most of the work consists of—

- (1) Digging.
- (2) Ridging.
- (3) *Bandhing*.

A digging gang consists of 30 B, units (either male gang or female gang).

A ridging gang consists of 30 C, units (male and female mixed) to make the ditch, with a corresponding number of D or G units to make the ridge. One worker makes the trench and ridge while the child breaks up the clods on the ridge to make a suitable seed bed for the development of the young seedling.

A *bandhing* gang consists of—

- 10 or 12 B diggers.
- 10 to 20 C earth-carriers.
- 10 C or D rammers.
- 10 to 20 or more G children and feeble old folk for clod-breaking.

A variety of miscellaneous jobs on each work also absorbs each its own small gang, i.e. (4) fencing, (5) well-making, (6) clearing trees and shrubs, (7) water-supply, (8) road-making, etc.

The standard task for every type of work has to be clearly defined. After a good deal of trial and experiment, the following standard tasks were finally adopted in the Etawah 1919 famine work :—

Standardiza-
tion of task.

(i) *Digging*.—The varieties of soil-hardness in these ravine lands are so considerable that one standard task for all conditions of soil was found to be impracticable. The following variations were adopted :—

(a) In soft flat ravine bottoms and where the soil had been worked in previous years—

1 B man—160 c.ft. (160 sq. ft. to 1 ft. depth).

1 gang of 30 B men, 4,800 c.ft.

(b) On average unworked land and moderate slopes—

1 B man—120 c.ft.

1 gang of 30 B men, 3,600 c.ft.

(c) On hard kankar ridges and very steep slopes—

1 B man—100 c.ft.

1 gang of 30 B men, 3,000 c.ft.

(d) Digging water-escapes for *bandhs*. Individual task—

1 B man 84 c.ft., i.e., 7' long, 6' broad, 2' deep.

For B women gangs for (a) and (b) The task was two-thirds of task for B men gangs.

(According to Famine Code rules, a woman is paid the same as a man, but does two-thirds of his work.)

(ii) *Ridging*.—This work involves digging a trench 1' deep and 2' broad (in soil previously dug by digging gangs) and heaping the soil therefrom in a triangular ridge on the downhill side.

Tasks—

B men 60 running feet of trench.

B women 40 running feet of trench.

C class 30 running feet of trench.

D and G children, breaking clods on the ridges, 1 child to 1 ridger (very old and feeble men and women were often used on this work also).

(iii) *Bandhing*.—The task was 120 c.ft. of earth or 1,440 c.ft. per gang of 12 men, if earth obtained from borrow pits.

For the C class carriers employed, the task was to carry this dug earth to *bandh* site (12 to 20 carriers employed). The children had to pulverise this quantity of earth on other miscellaneous tasks were—

(iv) *Fencing*.—One gang of 10 to 12 B men per work. Task 15 to 22 running feet of hedge per man, including collection of thorny shrubs, etc.; the hedge was 5' thick, with stout thorny branches fixed into holes on either side and centre filled in with loose thorns.

(v) *Water-supply*.—The gang varied with the distance of water and numbers on the work and the season up to the end of April. A man for every 200 labour for every furlong the water had to be brought. In May, increased to 1 man for every 150 labour, for every 150 yards.

(vi) *Well-making*.—The gang consisted of 1 mate (an experienced well-digger) 3 or 4 diggers—task 80 c.ft. per man.

3. Earth-removers increasing to 4, as well deepened.

These are the principal tasks. The adjustment of digging tasks was left to the Manager on the spot, under the control of the Range Officer.

Experience, as work opened, always showed a plethora of old and feeble men and women and young children, who should do nothing but clod-breaking. As employment has to be provided for all who come to works (under the Code only lepers and lunatics may be refused), a comparatively large number of *bandhs* had to be laid out, as *bandhing* work absorbs more clod-breakers than any other.

Scale of wages.

9. An idea of the scale of wages paid will be of interest to Forest Officers unaccustomed to labour conditions where villagers turn out *en masse* to work in order to live.

The wage scale is controlled by the price of the common food grain. In Etawah in 1919 the following wages were generally paid for a full day's work:—

Class of labour.				Daily wages.			Remarks.
				Rs	a.	p.	
B men and women	0	2	6	Wage basis, price of grain 6½ seers.
O (old and feeble) adults	..	..	..	0	2	3
D children (10—14) ..	..	..	..	0	1	3
G ditto (7—10) ..	..	..	..	0	2	0
Infants in arms ..	..	..	..	0	0	3

Chapter III.

CHECKING AND CONTROL.

10. The accounts procedure is given very fully in chapter XIX of the Famine Code. But a brief summary of the main outlines, as far as they concern the Divisional Forest Officer and his Range Officers, will possibly prove of assistance, as the procedure is very different to ordinary Forest Accounts. The system is based on a permanent fixed advance. Everyone has an advance of varying size, i.e., a Works Manager has an advance equal to three days' expenditure (Rs. 100 to 300) received from his Range Officer. A Range Officer has an advance equal to ten days' expenditure (Rs. 2,000 to 4,000). He keeps some in cash and advances some to his Works Managers, who draw on him for more when their allotment is spent. Accounts.

The Divisional Forest Officer has a fairly large advance (Rs. 12,000) which he distributes to his Range Officers and a little to his famine head clerk.

Every Saturday afternoon Works Managers prepare the consolidated weekly summary for their work and submit to their Range Officer. He consolidates for his range and submits to the Divisional Famine Officer on Sunday morning. The consolidated accounts for the division have to be ready and submitted to Collectorate on Monday morning. Obviously there is no scope for dilatoriness or unpunctuality. Then on Monday the *exact* amount of the weekly expenditure is obtained from the Treasury and distributed *exactly* according to their accounts to Range Officers. Thus everyone is again in receipt of his full permanent advance, and so it goes on week after week.

There are, of course, no monthly accounts. The audit of accounts is done in the Collector's office.

11. The Divisional Forest Officer is solely responsible for all technical details, for the character and quantity of the work done, for the fixing of tasks, for the laying-out and construction of *bandhs* and all similar details. He is also very largely responsible for the due observance of Famine Code Procedure, but in this he is largely helped by the Collector and his inspecting officers, who bring to notice mistakes in procedure.

For Forest famine works intense supervision and continual surprise inspections are absolutely essential, more so than for any

The figures of advances show the amounts given out in the Etawah 1919 famine, to give some idea of their magnitude.

form of Departmental Forest work with which the writer is acquainted. This intense control is necessary not only to prevent swindling by Works Managers and foreman, but to keep the work up to the mark and ensure that full tasks are done.

The complete check and inspection of a Forest famine work is a long business; paragraph 42, Appendix D of Famine Code detail some points to be looked to, but the Forest Officer has in addition to examine and check the technical work. Experience only will show how a famine work should be inspected: it cannot be explained. It takes over three hours to do properly, and is rather an ordeal to carry out day after day in the middle of the hot weather in the pitiless, shadeless ravines.

Chapter IV.

MISCELLANEOUS.

Cost per acre.

12. There are several miscellaneous points worth recording as a result of experience gained in the 1919 famine work. One point is the cost per acre. It must be emphasised that the cost of soil-preparation by ordinary departmental methods is no criterion or standard when estimating for famine work, for several reasons. The main reason is that the work is done far more thoroughly by famine labour than we can possibly attempt to carry out departmentally, when the capital cost of creating plantations has continually to be borne in mind. The enormous mass of labour that has to be accommodated at famine time would result, if worked on ordinary lines, in preparing such an enormous area of new plantation that the subsequent sowing up and tending during the rains (when famine labour is no longer available), would be almost impossible. In fact the area worked is kept within workable limits by *increasing the intensity and quality of the work*. Again, the preliminary soil-loosening is normally done by ploughing in all flattish areas, and left undone on steep and precipitous slopes, but in famine time digging by hand labour is substituted, and is done everywhere, both on flat ground and steep slopes. Finally, the employment of numbers of old and feeble folk and young children, and various miscellaneous expenses not usually incurred [e.g., establishment (5 per cent.), mates (5 per cent.), water-supply and well-digging (5 per cent.), etc., add quite 20 per cent. to the cost of the work].

The cost per acre varies considerably with the locality, especially with the degree of steepness of the slopes. A calculation

was made for an acre of fairly steep ravine land and worked out as follows. Cost of soil-preparation per 1 acre :—

Nature of work.	Units of work.		Cost of unit annas.	Approximate cost per acre annas.	Remarks.
	Class of labour.	Number of units.			
(1) Digging ...	B	500	2½	1,250	
(2) Ridging ... {	C	150	2	} 500	
	D or G	150	1½		
(3) <i>Bandhing</i> ... {	B	25 to 50	2½	} 250 to 500.	<i>Bandhing</i> very variable.
	C	50 „ 100	2		
	D	30 „ 70	1½		
	G	25 „ 50	1		
(4) Miscellaneous (20 per cent. of above cost) ...	...	Add 10 per cent. of above.	...	400 to 450	For miscellaneous works add 10 per cent. to number of work units and 20 per cent. to total cost.
Total cost ... {	B	600	...	} As. 2,400 to 2,650.	
	C	250	...		
	D	200	...		
	G	100	...		

This gives roughly a cost of Rs. 150 to Rs. 165 per acre. Mild ravine country would reduce it by 25 per cent., while really bad and precipitous ravines, with 60' to 80' sheer drops, would increase the cost indefinitely. (It is not economical to work such areas at all from a plantation point of view, but sometimes they must be worked to check further erosion.)

13. This table represents the working of the soil with extraordinary thoroughness, far beyond anything that has ever been

Intensity of soil preparation.

attempted before. (As a natural consequence, the plantation results promise to be excellent.)

The cost per acre can, however, be materially reduced (without any serious difference in the subsequent success of the plantation) by omitting the breaking down of unnecessary precipitous slopes and by omitting the wholesale digging of steep slopes (on which the presence of loose soil tends to fill up the water ditches). The intensity of soil-preparation is in fact a most useful regulating factor; as already indicated, if the famine is severe and large numbers are expected on famine relief works, the soil-preparation must be intense to keep the area worked within reasonable limits; if the famine conditions are less severe, less intensive working will avoid a corresponding reduction in worked areas.

In the Etawah famine of 1919 there was no previous experience to guide us; when the scheme of work was prepared in the autumn, double the number of famine units of work were expected that actually came; the area worked was expected to reach 1,200 to 1,400 acres, which was as much as the Forest staff could have dealt with in the rains; actually about 700 to 800 acres of land was prepared.

It will be useful to bear this point in mind on future occasion.

Conclusion. 14. In conclusion it may be useful to summarise briefly the results of experience gained in the 1919 famine in the Etawah ravines—

- (i) Ravine reclamation is eminently suited to famine relief work.
- (ii) It required, however, by its very nature, by the variation in tasks, by the scattered working, by the continuous shifting of work, considerable intensity of supervision and inspection, more so than is required normally for other forms of famine relief work. Controlling charges must therefore be limited in size.
- (iii) With intense soil-breaking, the cost comes to about Rs. 150 to 160 per acre for average ravine country, and the number of work units per acre (vide table in paragraph 12) is roughly—

Adults	...	...	...	...	800
Children	...	...	...	...	300
				Total	1,100

- (iv) The number of work units and cost per acre can be materially reduced, if necessary, by leaving sheer cliffs unworked (where further erosion is not to be checked)

and by preparing ridges and ditches on steep slopes without soil working in between. In any one locality there is a definite maximum area which can be borne in mind, and considerable variations in labour-supply can to some extent be balanced by variations in intensity of soil working.

- (v) The standard tasks (detailed in paragraph 8) were found by experience to represent a good and fair day's work for the classes of labour. Fines for non-completion of task were very occasional.

These are the chief points worth noting. Their record in this note will, it is hoped, prove of value when next famine conditions occur, and famine labour is utilized on a large scale in ravine reclamation work.

E. A. SMYTHIES,
Divisional Forest Officer,
Afforestation division.

APPENDIX XV.

Extract from the final Famine Report of Etawah district by J. C. Nelson, Esq., I.C.S.

1. The organization of relief system.

(a) The revision of relief programmes.

The village works programme was taken in hand in September, 1918, as soon as it was certain that there would be famine in the dry tracts of the district. Most of the works entered in the programme were considered useless from every point of view except that merely of finding work for idle hands, and there was no project at all for the Bidhuna tahsil where the Arind tract cannot be neglected when any such agricultural situation arises. In the previous spring I had requested sanction to the acceptance as a famine work of the Ravine Reclamation system, and that sanction had been accorded. My request for the deputation at the time of an overseer to prepare projects in Bidhuna was not, however, acceded. The Divisional Forest Officer accordingly prepared, in consultation with me, a programme for ravine reclamation works in the Jumna-Chambal portion of the Etawah, Bharthana, and Auraiya tahsils. A few projects of the village works programme were also worked out and other works were improvised. The system that had to be adopted was defined for us by the absence of any outside professional assistance, even medical. I accordingly decided at once that we would have no big works or residential camps, and that the people must be kept at their homes. This entailed the finding of suitable works at comparatively short distances one from each other, so that the "catchment area," so to speak of the works, would cover the whole scarcity tract, without leaving blanks and without undue overlapping. Ravine reclamation works were carried out wherever the Forest department (whose staff was also limited) would manage it, with due consideration also to the utility of the works, and the rest of the area was then dealt with by selecting works of genuine local utility at suitable spots and arranging for a succession of works also, when necessary.

1. (b) Any other arrangement requiring notice.

With a failure of monsoon, a fodder famine in the Trans-Jumna tract is always to be expected and its treatment is nearly as important as that of the food famine. The experience we have bought in a hard school this year shows that it is not enough to bring by rail, but assistance must be given in the transport of this hay to the remoter villages. I propose to leave on the famine file a short memo. on the detailed steps that we have learnt to be necessary. In general the system I adopted was to establish

sub-dépôts across the rivers to serve the more inaccessible and more distant tracts, where the people themselves could deal with the remaining short lead, and to assist others by giving a cash advance for hired transport as well as an order for hay against their Tagavi bond. Transport to these sub-dépôts I financed out of the District Famine Fund. Arrangements should be made by the Department of Land Records and Agriculture much earlier for the supply of hay. I was allotted 1,50,000 maunds by them. I had asked for this supply to commence by 15th December, but none arrived till nearly the end of January and the amounts received at first were derisory. In January I received under 4,000 maunds, in February under 13,000, in March under 12,000, and in April under 16,000 maunds. In all I received under 90,000 maunds

In the remoter parts of this tract also it will be found that, with a complete failure of the *kharif* and no prospect of *rabi*, the small banias who inhabit many of the smaller villages will leave and that grain is not to be had at all in many hamlets. Transport is so difficult that ordinary laws of supply and demand cease to work as was the case all over India before railways came. Arrangements were, therefore, necessary for grain dépôts, whence villages can draw their supplies, at one or more suitable places; there should be no difficulty in getting some big trade or landowner to arrange for this. It should be easy in an ordinary famine year which is not complicated with railway restrictions.

The first test work was opened on the 30th November, 1918, under the Forest department. During the month of December, 1918, four forest works and three other works were started one after the other. There were 14 such works open when scarcity was declared on the 27th January, 1919. Test works were opened in the lower Sengur valley, but were found unnecessary, and were closed after a fairly long trial. Relief was not found necessary there. None were tried in the Sengur-Sirsa doab. It is evident, I think, that these two rather precarious tracts will not need relief in future in the event of the failure however complete of one monsoon, unless it follows a series of bad seasons.

The backbone of the system was the ravine reclamation work; the rest were tanks and *bandhs* for the most part according to what was suitable to local conditions.

In the Etawah sub-division, where the watering of cattle is a great difficulty, all the works were tanks. In the Auraiya Kharka and Trans-Jumna with few exceptions the works were all *bandhs*, the terrain there being suitable for them and watering difficulties not usually so great. A few road repairs were done where they

2. The first opening of poor-houses and test works.

3. Village civil works.

(a) Their nature and sufficiency, classes of people employed on them.

were really useful, and I hope that the old "permit line" road which was broken in two by a mass of ravines, in one place for a distance of about a mile and a half, thereby completely interrupting communications, will be restored to good working order and will continue to be suitable for wheeled traffic for many years to come. This particular work is not yet completed: it is being financed now by the District Board. The vast majority of people who frequented the work were, as usual, ordinary labourers and cultivators of the lower castes, but this time some Thakurs and Brahmans were to be found on almost all works, not only as mates, in which capacity they joined readily enough at the start, but also among the rank and file of the workers. At one very poor village where the population is predominantly Brahman, this caste formed a very large proportion of the workers and were kept in separate gangs.

3. (b) The extent to which dependants were relieved on village civil works.

Dependants were not relieved. The Famine Commissioner, however, sanctioned the relief of "G class" children with the directions that they should be given light work. Accordingly children of 7 to 10 years of age were allowed on relief works from the third week of March. They worked at old-breaking and ramming with tiny wooden "chapis." This met the case well. It pleased the parents whose children were kept under their eyes and out of mischief and prevented the overloading of the gratuitous relief lists with children who are old enough to have the duty to work impressed on them.

3. (c) How far female exceeded male workers and consequent increase of dependants (if any).

On the forest works the number of women was always below that of male workers, probably because the works were at some distance in the ravines and in most cases at a considerable distance from the hamlets themselves. Conditions were very trying there, there never being even a vestige of shade, and the heat was excessive for children who naturally go with their mothers.

3. (d) Amount of earthwork done.

Amount of earthwork done on civil works comes to 10,209,664 cubic feet. On forest works the area worked over was 900 acres and the earthwork done thereon was 126,933,632 cubic feet. The grand total is therefore 137,145,296 cubic feet.

3. (e) Rate per 1,000 cubic feet.

On civil works the rate per 1,000 cubic feet comes to Rs. 7.47, while on forest works it was between Rs. 181 and Rs. 182 per acre. It is not possible to calculate the rate per 1,000 cubic feet of earthwork done on forest works, as much of the work cannot be put into cubic feet. The reasons are explained in the note recorded by the Divisional Forest Officer which forms an annexure to this report.

3. (f) Cost of relief per unit.

The cost of relief on civil works works out at 2.04 annas per unit, while on Forest works it was 2 annas 1 pie.

3. (g) Their success in relieving distress.

There is no doubt that the system of bringing the work to the workers instead of taking the workers to the work is far the more

efficient, as a means of relieving distress. There is no upsetting of the communal life of the village, families are not broken up, the cattle are properly looked after, the people kept in better spirits, and the risk of epidemic is greatly diminished by avoiding concentrated camps and big crowded works. When everyone comes in the morning and leaves in the afternoon, the risk of fouling the land in the neighbourhood is enormously diminished, and in the case of Forest works, where the ground worked over changes all the time, is practically eliminated. The principal difficulties are two : firstly, the finding of a sufficient number of decently honest and capable managers, and, secondly, the necessity for continued supervision by gazetted officers, involving as it does appalling exposure in an arid and treeless tract. The first results in a great practical difficulty in exacting a full task and also in very high "overhead charge." I personally think the advantages far outweigh the disadvantages.

One naib-tahsildar or selected qanungo was posted in each tahsil to work as circle officer. They had to inspect all the works and were held primarily responsible for their proper management. Direct supervision of gratuitous relief was also entrusted to them. The Forest works were in the hands of the Divisional Forest Officer, but the Circle Officers concerned and the Divisional Officers inspected and reported on them from all points of view except purely technical ones. On each of the works there was one manager, one or more moharrirs or foremen according to the number of labourers, two peons, and a storekeeper.

The loss of cattle owing to scarcity of fodder is estimated at 40,000, of which, however, probably only about 10,000 consisted of bullocks, special care being taken of plough cattle.

The replacement of the cattle lost is not easy and must take some years. The resources of the cultivators in the distressed tracts are at very low ebb and they are already burdened with the Government taqavi advances which will have to be recovered immediately, so that unless there is a succession of good years, the damage done is not likely to be remedied for some time especially as it is likely to be aggravated by a low birth-rate as a direct result of poor nutrition. But for the complete remission of the revenue for both instalments in the Trans-Jumna tract, it would be impossible for these people to get level for a long time. The price of cattle runs very high.

We owe a special debt of gratitude to the officers of the Forest department who conducted a very important and very difficult experiment to what I consider a most successful conclusion. This involved unremitting labour on their part and all in addition to their ordinary duties. The conditions under which this labour was

3. (h) The management of the work and the staff employed.

5. Loss of cattle.

(a) Proportion of plough cattle lost to cattle in general in the district.

5. (b) Anticipation for the replacement of lost cattle.

6. The working of staff of all grades, civil, military, officials, and non-officials.

performed have already been described ; they reached about the limit of human endurance. Without great organizing ability the experiment could not have been successful, as difficulties arose day by day which had to be met day by day with new adaptations. These services rendered so ungrudgingly and cheerfully by Messrs. E. A. Smythies, E. Benskin, and M. J. McDonald deserve the most cordial recognition.

APPENDIX XVI.

List of Forest Officers employed on Afforestation.

Officers in charge.

E. A. Courthope, Deputy Conservator of Forests, 7th December to 2nd May, 1915.

E. Benskin, M.A., Deputy Conservator of Forests, 2nd May, 1915 to 25th August, 1917.

Babu Girdhari Lal, Extra Assistant Conservator of Forests, 25th August 1917 to 10th November, 1917.

Lala Kali Charan, Extra Assistant Conservator of Forests, 10th November, 1917 to 23rd April, 1918.

E. Benskin, M.A., Deputy Conservator of Forests, 23rd April, 1918 to 1st April, 1919.

E. A. Smythies, B.A., Deputy Conservator of Forests, 1st April to 21st October, 1919.

M. J. McDonald, Extra Assistant Conservator of Forests, 21st October, 1919.

Officers attached.

* G. K. Murphy, Extra Assistant Conservator of Forests, 26th February, 1914 to 19th May, 1917.

H. W. Moor, Extra Assistant Conservator of Forests, 1914 to 1917.

* W. A. Bailey, B.A., Deputy Conservator of Forests, 30th November, 1914 to 16th July, 1915.

E. Benskin, M.A., Deputy Conservator of Forests, 30th January to 2nd May, 1915.

Babu Girdhari Lal, Extra Assistant Conservator of Forests, 24th June to 25th August 1917.

* Lala Hukum Chand, Extra Assistant Conservator of Forests, 7th August, 1917 to 25th April, 1918.

M. J. McDonald, Extra Assistant Conservator of Forests, 28th March to 23rd June, 1917, and 11th May, 1918 to 21st October, 1919.

• These officers held charge of the Etawah division for short periods.

APPENDIX XVII.

Copy of a G. O. no. 1503/XIII—142 of the 9th September, 1920, on the future policy of Government with regard to afforestation.

FOREST DEPARTMENT.

I am directed to invite a reference to this Government's resolution no. 971/XIV—179, dated the 21st December, 1914 (copy enclosed for ready reference), in paragraph 9, of which the general policy to be observed in regard to the work of afforestation was laid down. The underlined ideas of that policy were—

- (1) the reclamation of ravine land with the object of rendering profitable land already ruined and of preventing further ruin of the country-side by erosion ;
- (2) the provision of fuel and fodder reserves, thereby increasing the supply of grass and the creation of the suitable breeding grounds for cattle ; and
- (3) an increase in the supply of babul bark for the Cawnpore Tanneries.

No attempt, however, was then made to work out or co-ordinate the methods by which these three results could be arrived at, as it was felt that experience alone could suggest a solution of the problem. It was decided that a beginning should be made by inviting landholders in the Jumna-Chambal ravine tract in the Etawah district to submit applications under section 38 of the Indian Forest Act, and over 20,000 acres in that tract were accordingly handed over to the Forest department under agreement, practically all by three large landholders who were glad to oblige Government in that matter.

2. The area thus acquired has been under the management of the Forest department for about four years and the following conclusions emerge from the experience that has now been gained :—

- (1) that from the point of view of universal ravine reclamation the scheme is of the limited value. Afforestation as a method of dealing with such ravines is now a proven success, but as a practical proposition the method is not capable of universal application. Its effect on the ground reclaimed is admirable and it prevents further encroachment by ravines on the agricultural land directly behind it, but it is always liable to be "outflanked" by untreated ravines, so that unless the blocks taken up are large, the protective effect is small and local. Further, as the majority of the villages are situated

on the actual edge of the ravine country, it is impossible to afforest a continuous belt of land along the tops of the ravines, owing to the natural reluctance of the villagers to allow the land immediately surrounding their village sites to be taken up for afforestation. The scheme originally mooted therefore, which has for its ultimate object the reclamation of the whole Jumna-Chambal ravine tract solely by means of afforestation, is in practice impossible. The only possibility in these circumstances is a scheme in which the villagers will willingly co-operate. This implies that the scheme must be one which appears to them as a profitable one from the start. It has seemed probable that in much of the area under consideration it might be possible to break down the ravines and with a minimum of tree-planting on the steeper slopes render the land suitable for the production of fodder, or even suitable for agriculture. It is understood that further experiments in this line are necessary before any definite conclusion can be reached.

- (2) That as a scheme for producing babul-bark, firewood, small timber for local use, and improved grazing and grass-supply it is a great practical success, but not likely to be a financial success without the addition of valuable timber. This, however, fortunately grows well in places and has been planted wherever possible during the last few years.
- (3) That any considerable extension of the area already taken up will become possible only when the Forest department have demonstrated beyond all possibility of doubt the benefit to be derived from the scheme by both landholders and tenants.

3. The agreement into which the Etawah landlords entered is not considered equitable by them. His Honour has therefore approved the terms of the agreement proposed by you, which it is believed will render the scheme not only attractive to them, but also to other landlords who on the present terms are not willing to co-operate. The changes embodied in the agreement are to the following effect :—

- (1) that the owners of the land taken up will, in future, receive payment from the Government at the rate of 8 annas per acre or one-fourth of the net profits accruing therefrom, whichever is greater ; and
- (2) that the capital expenditure, which will be provided entirely by Government, will not be redeemed on completion

of afforestation operations but will remain outstanding, the annual profits, which will be divided between Government and the owner, providing the return thereon.

4. The scheme outlined above is based on a change of policy dictated by the lessons gained by experience. It implies the definite abandonment of the scheme of universal ravine reclamation by afforestation alone, such abandonment being obviously inevitable. The intention now is to render reclamation attractive as a business proposition to the people themselves. This object has been kept in view in revising the agreement and must be an important criterion in judging the experiments referred to in the last part of paragraph 2 (1) *supra*.

5. I am accordingly to request that, in view of the foregoing observations, steps may be taken to institute experiments on the lines indicated above as soon as possible.

6. I am also to convey the approval of Government to the proposal of the Forest department to the charging of fees to persons who are not right-holders, to the continuance of the development of the areas already taken up by the present methods, the success of which has been fully demonstrated, wherever these areas show prospects of a reasonable financial return, and to the extension of their operations to other suitable localities as occasion offers and financial considerations allow. It is understood that the extension of these operations may ultimately involve the creation of two new divisions.

7. As regards the financing of the scheme, His Honour is of the opinion that the Forest department should not be charged with the whole capital expenditure incurred in the reclamation of areas which could not possibly give any return; if considered solely as a financial proposition, but where reclamation works would only be undertaken purely as a protective measure. The decision therefore to undertake a work of this class should lie with the revenue authorities.

APPENDIX XVIII.

Revised agreement with owners of waste land as approved by G. O.
no. 1608/XIV—142 of 2nd October, 1920.

AGREEMENT.

This indenture made the _____ day of _____ 192
BETWEEN the SECRETARY OF STATE FOR INDIA IN COUNCIL here-
inafter called the "Secretary of State" of the one part AND
OF _____ resident
of _____ in the district of _____
hereinafter called "the Owner" of the other part and WHEREAS
the Local Government of the United Provinces of Agra and Oudh
hereinafter called "the Local Government" have decided to take
over certain areas of land upon the application of the owner afore-
said with a view to the preservation formation or conservation of
forests thereon AND WHEREAS THE said owner made an application
on the _____ day of _____ to the said Local Government
praying that the land set forth in the schedule hereto annexed be
taken under the management of the Forest department of the said
Local Government for the purposes aforementioned AND WHEREAS
the said Secretary of State and the said owner have agreed that
the said land set forth in the schedule hereto annexed shall be
placed under the management of the said Forest department subject
to the following conditions :—

- (1) That the land be gazetted as reserved forests under sections
4 and 19 of the Indian Forest Act (VII of 1878).
- (2) That subject to the terms of the Forest settlement the
Forest Officer appointed by the said Forest department
in that behalf shall have full powers of control regarding
the treatment of the land the allotment and regulation
of grazing the felling of the trees and removal of all
produce and shall have power to close such areas to
grazing as he may deem fit for such period as he may

think necessary and to impose such grazing fees in such areas as he may think fit.

- (3) That any complaint against the action of the Forest department or any dispute arising under this agreement shall be referred to the Collector of the district. An appeal from the decision of the Collector shall lie to the Commissioner of the division whose decision shall be final.
- (4) The Local Government will pay the whole expenditure involved in the operations undertaken by the Forest department and in addition will pay to the owner annually on or before the first of June next following the close of the financial year for which the payment is due a sum equivalent to eight annas per acre on that area on which actual afforestation operations have been undertaken and will also collect and credit to itself all income accruing from the said areas provided that when one-quarter of the net profit on any estate exceeds the aforesaid sum then the Local Government will pay to the said owner one-quarter of the net profit in lieu of the said payment of eight annas per acre.
- (5) That the following accounts will be maintained for each estate separately and for the forest as a whole namely capital revenue and expenditure accounts.
- (6) That on the receipt side of revenue and expenditure account will be credited all cash and book transfer receipts of every description. On the expenditure or debit side of the revenue and expenditure account will be entered all cash and book transfer expenditure of every description including Government revenue that is now assessed or may be in future assessed on the said area or portion of the said area and the aforesaid annual payment to the owner and such supervision and establishment charges as the Local Government may from time to time determine. The said owner shall have no voice in the decision

of the amount of the expenditure which the Forest department may consider necessary.

- (7) That at the close of every financial year the revenue and expenditure account shall be totalled and the deficit or profit shall be carried to the capital account.
- (8) That so long as the expenditure exceeds the receipts the excess will be carried to the debit of the capital account. At the end of the financial year interest at 4 per cent. shall be added to the total sum of the debit side of the capital account outstanding from the previous year and 2 per cent. in respect of the total deficit of the current year.
- (9) That when the revenue and expenditure account shows a profit it shall be carried to the credit of the capital account and deducted from the total on the debit side.
- (10) That expenditure on works in each estate will be kept separate and each estate will be debited with its share of all expenditure as laid down in clause (6) subject to the proviso that no estate will be debited with any expenditure until that estate has been gazetted under section 4 of the Forest Act and management assumed by the Forest department.
- (11) That the profits derived from the area belonging to each separate estate will be kept separately. In the case of a contract covering two or more estates the profit and loss will be divided between the estates proportionately to their area.
- (12) That a copy of the yearly capital and revenue and expenditure account for each estate shall each year be sent to the owner or owners of the estate on or before the first of June in each year.
- (13) That in the event of any dispute arising as to the revenue and expenditure account the Local Government shall appoint a chartered accountant to audit the same which audit shall be final and the fee chargeable by

such chartered accountant will be debited to the said account.

(14) That the Secretary of State may at any time relinquish the said lands set forth in the schedule hereto annexed.

(15) That if the Secretary of State relinquishes the said lands the said owner shall not be liable to pay Government any amount that may be standing at the debit of the capital account.

(16) When an estate has been completely afforested to the satisfaction of the Forest Officers and the gross income exceeds the gross expenditure the capital account will be closed and the net profits distributed in accordance with the provisions of clause (4) namely three-quarters of the net profits to the Forest department and one-quarter to the owner.

PROVIDED AND IT IS HEREBY FURTHER AGREED that any part or parts of the said lands hereby taken under the management of the Forest department by these presents may be cleared and broken up for the purposes of cultivation or any other purpose in which event should such land be rendered liable to assessment to Government revenue under the law in force for the time being the said Local Government may assess such part or parts so broken up and brought under cultivation to Government revenue AND IT IS FURTHER AGREED AND DECLARED that out of any profits that shall accrue from lands placed under cultivation under the foregoing clause one-half shall be paid to the owner and the other half be placed to the credit of the revenue and expenditure account. AND IT IS HEREBY FURTHER AGREED that if the said owner should desire at any time to take back the land set forth in the schedule hereto annexed into his own occupation and management he shall have the option of doing so upon his giving twelve months' previous notice in writing expiring on the thirty-first March of his intention so to do to the said Local Government and upon paying to the said Local Government the balance if any due on the said capital account and upon his executing and undertaking to manage the

said lands set forth in the schedule hereto annexed in a manner to be laid down by the said Local Government and such land so taken shall be subject to the payment of the Government revenue which then or may at any time thereafter be assessed upon the said land so taken back or any portion thereof AND in the event of a breach of any of the terms laid down by the Local Government for the management of the said property as aforesaid by the said owner then it shall be lawful for the said Secretary of State to re-enter into and upon the said lands set forth in the schedule hereto annexed and occupy and manage the same under the conditions laid down in this agreement for as long as the said Local Government pays to him the said owner the profits payable to him under this agreement.

In witness whereof the parties hereto have set their hands the day and year first above written.

Signature of owner.

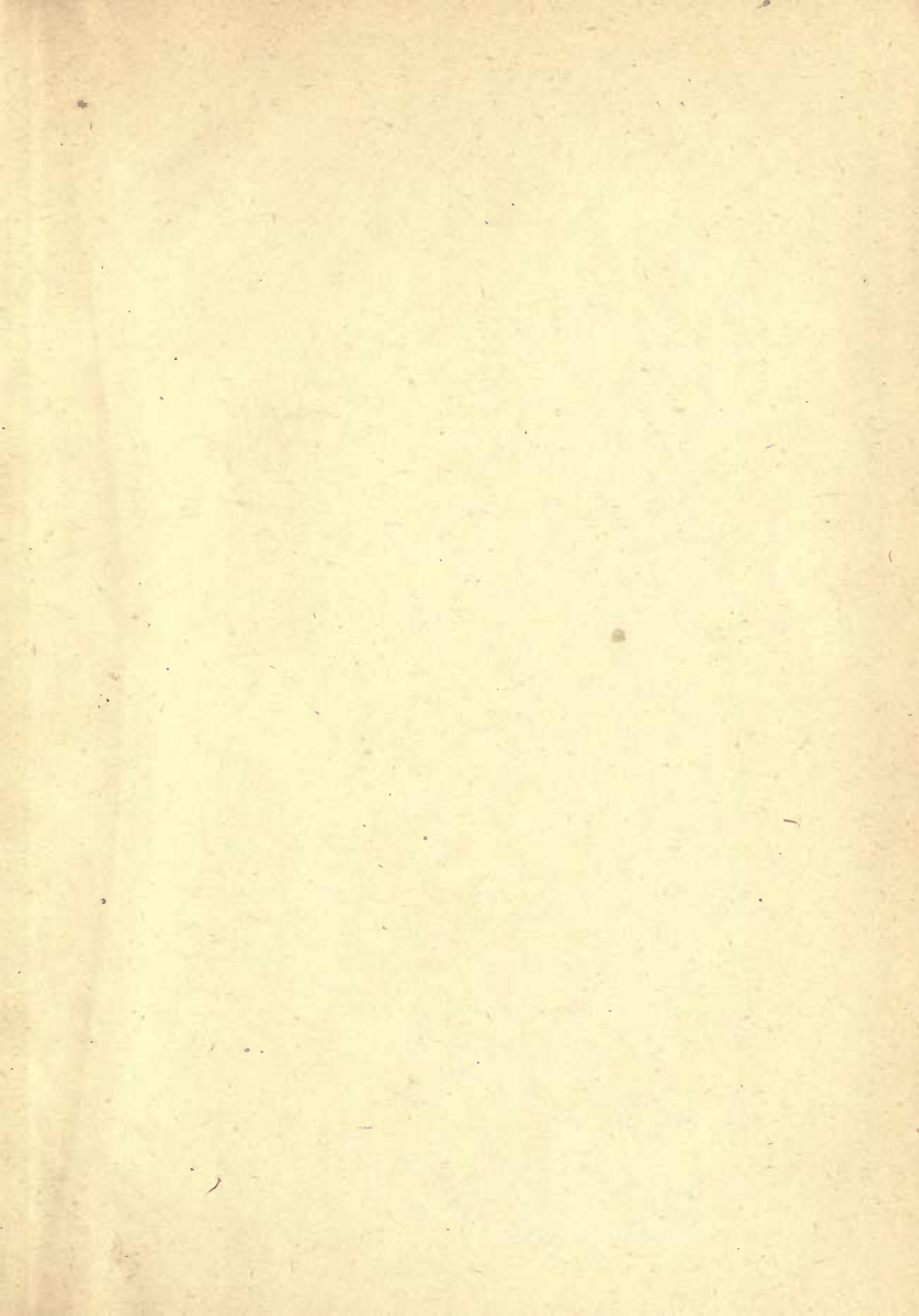
*Secretary to Government,
United Provinces.*

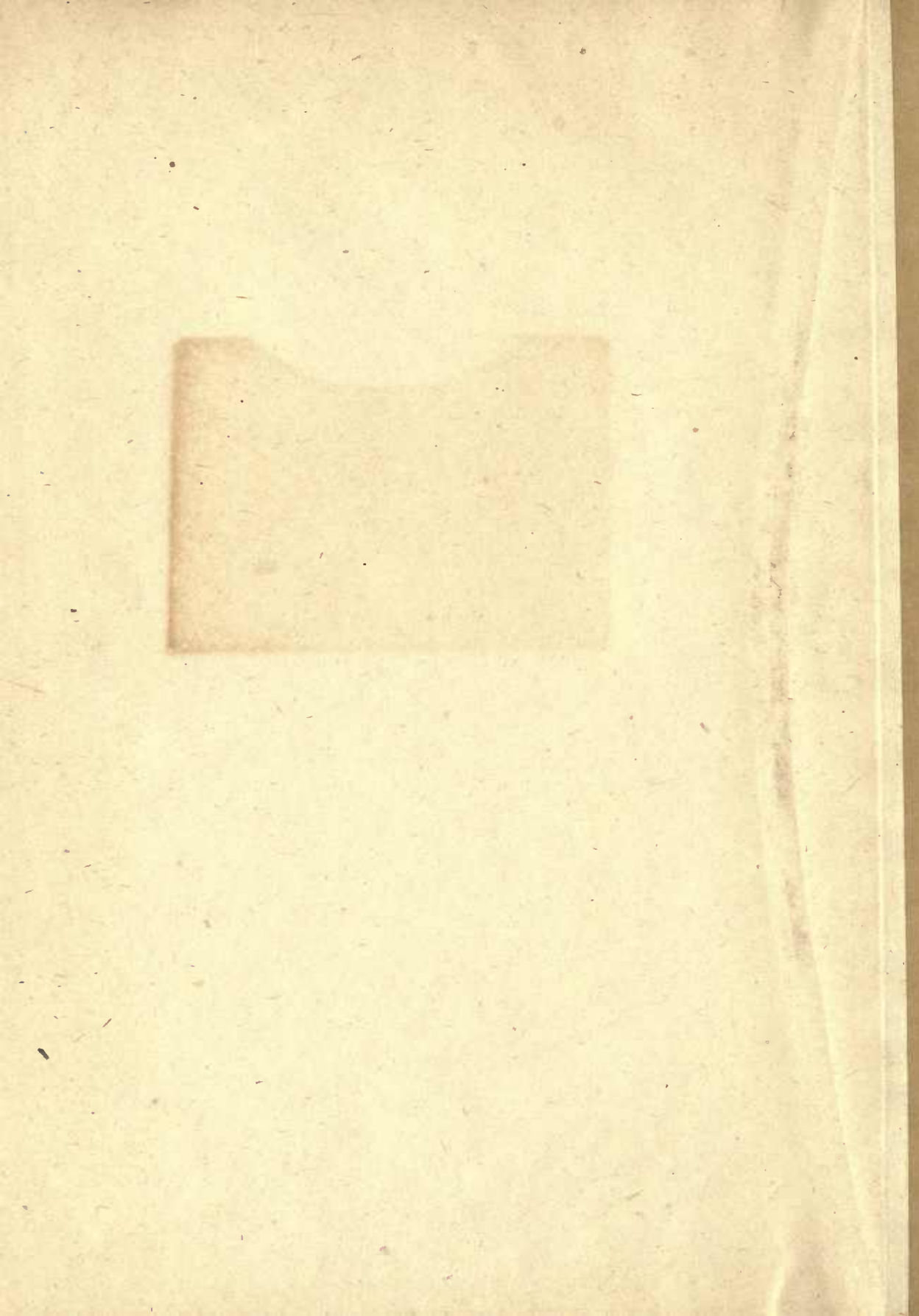
Witness.

Witness.

Witness.

Witness.





Afforestation in the United Provinces, India.

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